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FORECASTING TRAFFICABILITY OF SOILS

Report 8

VARIABILITY OF PHYSICAL PROPERTIES OF LOESS SOILS WARREN COUNTY, MISSISSIPPI

by

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CORPS OF ENGINEERS
Vicksburg, Mississippi

ARMY-MRC VICKSBURG, MISS.

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FORFWORD

The study reported herein is part of a research program being conducted under Task 1-V-0-21701-A-046-02, "Surface Mobility," of Department of the Army Project 1-V-0-21701-A-046, "Trafficability and Mobility Research," under the sponsorship and guidance of the Directorate of Research and Development, U. S. Army Materiel Command. The study was conducted by personnel of the U. S. Army Engineer Waterways Experiment Station (WES), Mobility and Environmental (M&E) Division, under the general supervision of Mr. W. J. Turnbull, Technical Assistant for Soils and Environmental Engineering; Mr. W. G. Shockley, Chief, M&E Division; Mr. S. J. Knight, Assistant Chief, M&E Division; Mr. A. A. Rula, Chief, Vehicle Studies Branch; and Mr. E. S. Rush, Chief, Soil-Vehicle Studies Section.

The initial fieldwork and analyses were conducted during 1958-1960 by the Forest Service, U. S. Department of Agriculture, with Mr. L. E. Andrew as project leader under the supervision of Mr. H. D. Burke and Dr. F. W. Stearns of the Southern Forest Experiment Station. The final analyses were made and the report was prepared by Mr. C. A. Carlson and the late Mr. A. R. McDaniel.

Directors of the WES during the conduct of this study and the preparation and publication of this report were COL Edmund H. Lang, CE, COL Alex G. Sutton, Jr., CE, and COL John R. Oswalt, Jr., CE. Technical Director was Mr. J. B. Tiffany.

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CONVERSION FACTORS, BRITISH TO METRIC UNITS OF MEASUREMENT

British units of measurement used in this report can be converted to metric units as follows:

Multiply	By	To Obtain
inches	2.54	centimeters
feet	0.3048	meters
miles	1.609344	kilometers
acres	4046.9	square meters
pints	0.473166	liters
pounds	0.45359237	kilograms
square inches	6.4516	square centimeters

SUMMARY

This study was undertaken to determine if the average of soil strength values obtained in a small area can be reliably applied to larger areas. The values of those soil properties commonly used in predicting soil strength and classifying soils were compared for areas differing in size. Six test sites in each of four soil series of loessial origin were established in Warren County, Mississippi, using series boundaries on soil survey maps for locating the sites. The series were the Memphis and Loring in the uplands and the Collins and Falaya in the bottomlands. Each site consisted of five sampling rows and each row had four sampling positions. Plots of pedologically distinct soil series were identified from field examination within sites and were used as an additional subdivision of test areas. Tests were conducted on four occasions to collect data on soil strength and moisture content, and once to collect data on other physical properties of the soil.

The four soil series could not be distinguished by soil strength because the cone index varied widely for any one series and the range of cone index for each series was approximately the same. The soils of the 6- to 12-in. layer of the uplands differed from those of the bottomlands in clay content and plasticity, but there was no corresponding difference in strength. The poorly drained Henry series and alluvial-fill soils of the uplands, as identified in the field, had the lowest cone indexes. Certain plots exhibited consistently different cone indexes for each sampling visit than did other plots in the same series, and certain rows in the same plot showed consistently different cone indexes. However, these differences could not be explained satisfactorily in terms of soil series, or soil properties commonly used in the Unified Soil Classification System and the U. S. Department of Agriculture textural classification. Limited data suggest that in future trafficability studies a terrain geometry classification system would be useful for identifying areas considered uniform in soil type but variable in soil strength by indicating areas having differences in reception or retention of water and differential erosion or deposition. Also, the effect of soil factors such as organic matter content, structure, and natural cementing agents should be determined. In a row of relatively uniform soil, five samplings for moisture content and static physical properties, and 10 measurements for soil strength should be made to provide acceptable mean values for trafficability use.

Basic data for each test site are included as Appendix A.

FORECASTING TRAFFICABILITY OF SOILS

VARIABILITY OF PHYSICAL PROPERTIES OF LOESS SOILS
WARREN COUNTY, MISSISSIPPI

PART I: INTRODUCTION

Background

1. In 1945, the U. S. Army Engineer Waterways Experiment Station (WES) began a series of investigations to determine and evaluate soil properties that affect movement of military vehicles.[1] Instruments were designed and built to measure soil strength, and soil strength measurements were correlated with the performance of a wide range of vehicles in prepared test lanes. Later, many soils in different terrains were studied to determine soil strength-vehicle performance relations. Other studies were conducted under diverse soil, weather, and site conditions to develop methods for predicting soil moisture content and its influence on trafficability. From these studies, trafficability classifications and tentative methods for predicting soil moisture have been derived.[2,3]

2. The soil moisture and strength prediction methods were developed from test data obtained from relatively small areas, about the size of a conventional military vehicle. The measurements obtained in these tests are averages of soil property values that occur within the overall ground contact area of the vehicle. Although studies have been conducted to determine specific soil and site conditions for small test areas, no test has been made of the validity of applying these measurements over large areas. The next step, then, is to determine if the measurements obtained from tests in small areas can be applied to large areas or extrapolated to other areas of similar soil. Knowledge is needed, also, of soil and site factors that define and bound an area considered uniform for soil trafficability purposes.

Purpose

3. The purposes of this study were to:

   a. Determine if the average of soil strength values obtained in a small area can be reliably used for a larger area of similar soil.

   b. Determine whether the application of small area test results to larger areas is consistent with passage of time, as the soil moisture content changes.

   c. Determine whether the variations in values of static soil properties (i.e. those that do not vary with time) and site factors used in soil moisture prediction methods are consistent with variations in strengths for small and large areas.

   d. Consider the influence on soil strength of soil and site factors other than those that have been intensely studied.

   e. Determine variation and sampling intensities of soil properties, pertinent to trafficability prediction.

Scope

4. The study was confined to relatively uniform soils developed from loess in Warren County, Mississippi. Four pedological soil series, two in upland positions differing in drainage and two in bottomland positions differing in drainage, were examined. Data were collected at 24 sites, six on each soil series. The static properties and site factors for each site were measured once during the winter-spring period. The dynamic properties that vary with time (i.e. soil strength and moisture content), were measured on four occasions during the year following the measurement of the static properties.

Definitions

5. Specialized terms used in this report are defined below.

<u>Soil series.</u> A group of soils having genetic horizons similar in diagnostic characteristics and arrangement in the soil profile, and developed from a particular type of parent material. Except for texture, especially of the A horizon, the morphological features of the soil profile,

as exhibited in the physical characteristics and thickness of the soil horizons, do not vary significantly within a series.

Loess. Deposit of windblown material, predominantly silty in texture but often containing significant amounts of clay and fine sand.

Soil separates. Mineral particles, less than 2 mm in equivalent diameter, ranging between specified size limits. The names and sizes of separates recognized in the United States are sand, 2.0-0.05 mm; silt, 0.05-0.002 mm; and clay, <0.002 mm.

Fines. Soil grains finer than 0.074 mm (passing a No. 200 sieve).

Liquid limit (LL). The moisture content at which a pat of soil, cut by a groove of standard dimensions, will flow together for a distance of 1/2 in.* under the impact of 25 blows with a standard instrument and procedure. It represents the moisture content at which the characteristics of a mixture of soil and water change from plastic to liquid.

Plastic limit (PL). The moisture content at which a soil just begins to crumble when rolled out into 1/8-in.-diameter threads. It represents the moisture content corresponding to an arbitrary limit between the plastic and semisolid states of consistency.

Plasticity index (PI). The numerical difference in moisture content between the liquid and plastic limits.

Specific gravity. The ratio of the weight of soil after drying to a constant weight at 105 C to the weight of an equal volume of water.

Dry density. Weight of soil after drying at 105 C to a constant weight per unit volume of the soil in its natural structure, expressed as pounds per cubic foot or grams per cubic centimeter. It is comparable to bulk density and dry unit weight of intact samples.

Soil moisture content (MC). The soil moisture content expressed as a percentage of the weight of water driven off at 105 C to the weight of the remaining dry soil.

Moisture tension. Considered to be the force or tension by which water is held to the surface of soil particles or within interstices; it

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* A table of factors for converting British units of measurement to metric units is given on page vii.

varies inversely with the soil moisture content. The moisture-tension relation for a particular soil is determined by means of a laboratory device at a sequence of tension or pressure settings. At a given moisture content, the tension is equal to the negative or gage pressure to which free water in the instrument has been subjected in order to be in hydraulic equilibrium, through a permeable wall or membrane, with the water in the soil.

Dynamic property. A property whose value changes with time and weather, e.g. moisture content or soil strength.

Static property. A property with a fixed value, for this study considered unchangeable with time, e.g. grain size or plasticity.

Soil strength. The resistance of a soil to an applied stress. The strength varies with moisture content and the nature, arrangement, and size distribution of the soil particles, and the test itself. The principal unit of strength used in trafficability studies is cone index.

Trafficability. The ability of a soil to permit the movement of a military vehicle.

Critical layer. The layer of soil regarded as most pertinent to establishing relations between soil strength and vehicle performance. In fine-grained soils and sands with fines, poorly drained, it is usually the 6- to 12-in. layer. However, the critical layer may vary with weight of vehicle and with soil strength profile.

Cone index (CI). An index of the shearing resistance of soil obtained with the cone penetrometer. The value represents the resistance of the soil to penetration of a 30-deg cone of 0.5-sq-in. base or projected area. The number, although considered dimensionless, is actually pounds of force on the handle divided by the area of the cone base in square inches.

Remolding index (RI). A ratio expressing the change in strength of a soil that will occur under vehicular traffic.

Rating cone index (RCI). The product of the measured cone index and the remolding index for the critical layer of soil.

Cone penetrometer. A field instrument consisting of a shaft with a 30-deg right cone mounted on one end, and a proving ring with dial gage and handle mounted on the other.

Trafficability sampler. A piston-type soil sampler for obtaining soft soil samples. The sample may be used in its entirety for making a remolding test or cut to known volumes, by the use of spacer bars or pins, for determining dry density.

Remolding equipment. A cylinder of the same diameter as the trafficability sampler cylinder mounted vertically on a base, and a 2-1/2-lb drop hammer that travels 12 in. on an 18-in. section of a cone penetrometer shaft fitted with a circular foot.

Median. The value of the middle item in an array.

Mean. The average value of all items in a sample. It is calculated by dividing the algebraic sum of the observations by their number.

Normal distribution. A type of distribution that serves to describe the frequency of occurrence of many natural facts and phenomena. It has an exact mathematical expression and is the basis of most statistical measures and inferences.

Standard deviation from the mean. The standard deviation from the mean is an index of dispersion of individuals in a sample about the mean of the sample. It is calculated as the square root of the mean of the squared deviations taken from the mean of the distribution. For a sample having a normal distribution, 68 percent of the individuals will have values within plus or minus one standard deviation from the mean.

Probability. As used in statistics, the probability of a given event is the expected frequency of occurrence of this event among events of like sort.

Significance. Significance is a measure of reliability. A given difference is called significant or reliable when the experimenter is satisfied that it cannot be explained away as having arisen from sampling fluctuations or sampling accidents.

Level of significance. A measure of reliability qualified by a statement of probability. A given difference is called significant at the 5 percent level if the probability is 95 times out of 100 that it cannot be explained as having arisen from a sampling accident; a difference is significant at the 1 percent level if the probability is 99 times out of 100 that it cannot be explained away as having arisen from a sampling accident.

Variance. An index of dispersion or variability of sample values or means. It is also called the mean square and is numerically equal to the square of the standard deviation.

F-test. A test comparing variances of two sets of values in a study in order to determine the probability of one set being like the other. The F-value is the ratio of the two variances, which in this study is that of the larger area, the plot variance, divided by that of the smaller area, the row variance. If the ratio is small, the variance of plot values is common with that of the rows within the plots, and the existence of plot differences is remote. If the ratio is large, exceeding a predetermined value based on a normal distribution, the probability exists that the plot values are not common with rows within plots and therefore that plot differences occur.

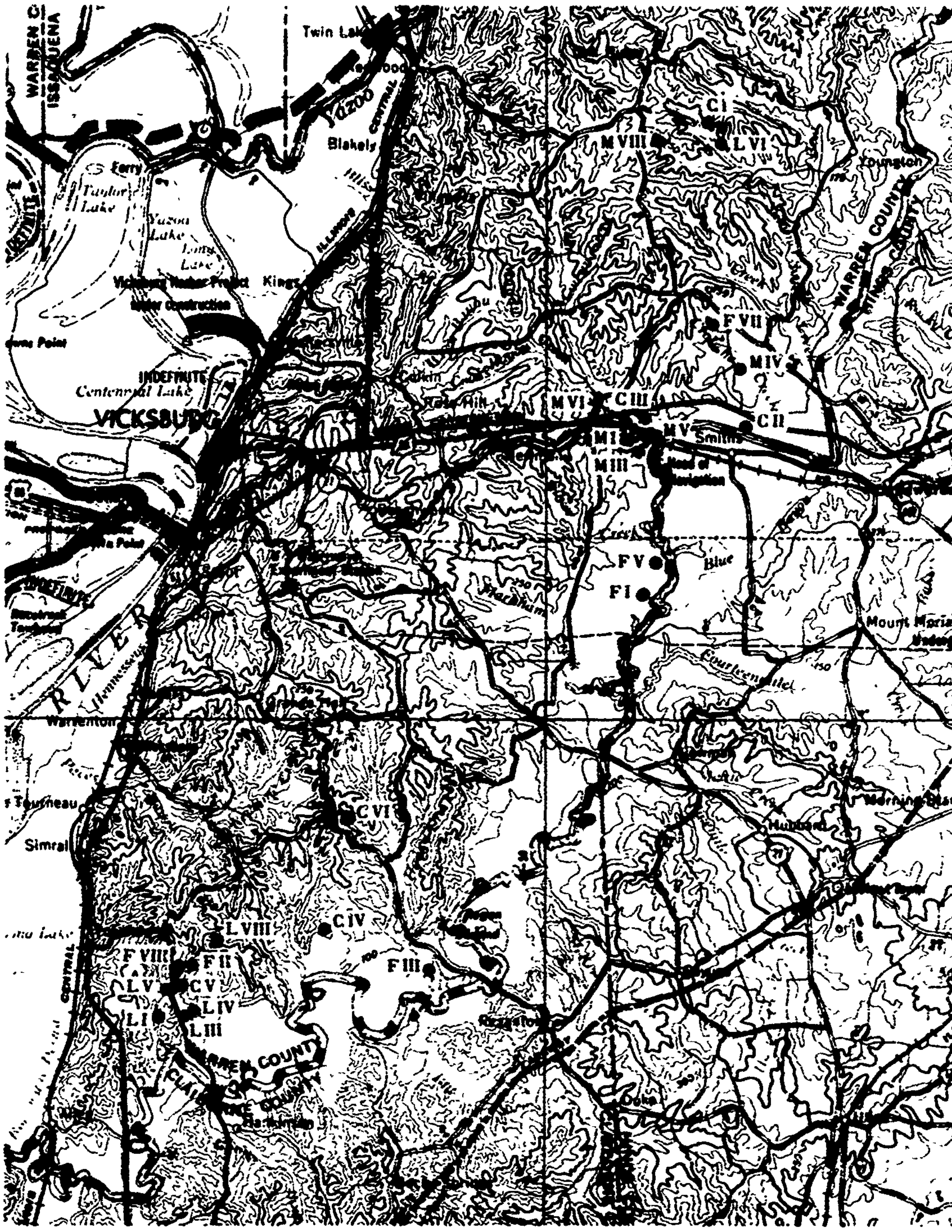
PART II: TEST PROGRAM

Test Area

6. The study was conducted in the eastern and southern parts of Warren County, Mississippi, in soils derived from loess overlying Tertiary sediments. The county is bounded on the east by the Big Black River, with a valley 1 to 2 miles wide, and on the west by the Mississippi River. The loess deposit thins from a depth of 60 ft near the Mississippi River Valley to a few feet on the hilltops 30 miles to the east. The deep loess has been severely eroded, forming narrow valleys with 30- to 100-ft differences in relief and with steep slopes that are frequently steeper than 50 percent. The valley bottoms are narrow and flat; the hilltops are often narrow ridges, although some wide, flat uplands occur. The loess hills bordering the Big Black River frequently have less slope and relief than the deeper loess hills further west. The terrain pattern of the test area is shown in fig. 1.

7. Soils developed from loess are relatively uniform, consisting primarily of silt, with some fine sand and clay. Differences occur between upland and bottomland soils. The upland loessial soils have weathered in place resulting in an increase in the clay content and a silty clay texture in a layer 10 to 20 in. below the surface, in contrast to a silt loam texture above and below the layer. Due to erosion of the surface at some locations, the clayey layer is at or near the surface. The bottomland soils are derived from recent alluvium washed in from the loess hills, and generally have a silt loam texture throughout the profile. Some bottomland soils along the Big Black River have higher contents of sand resulting from admixtures of sandy Tertiary materials. Loessial terrace soils also occur along the Big Black River, but these soils were not studied.

8. Sequences of soil series with drainages ranging from good to poor are distinguished for the upland and bottomland loessial soils of Warren County. In soils of the uplands, a fragipan occurs in and below the clayey layer. The prevalent soil series and approximate depths to the fragipan, where present, are as follows: Memphis, no fragipan; Loring, 36 in.; Grenada, 24 in.; and Henry, 16 in. In soils of the bottomlands, shallow



NOTE: SEE TABLE 1 FOR SITE IDENTIFICATION AND GENERAL DATA.

SCALE IN MILES

1 0 1 2 3 4 5

CONTOUR INTERVAL 50 FEET

Fig. 1. Test site locations

groundwater tables have developed a mottled structureless soil layer zone with dark gray and brown colors. The prevalent soil series and approximate depths to the mottled zone are as follows: Collins, 20 in.; Falaya, 10 in.; and Waverly, 3 in.

Test Sites

Selection

9. Sites were selected from soil survey maps of areas mapped as one soil series. It was desired to test soil series of uplands and bottomlands that differed widely in drainage, but examination of the maps showed that very poor and very well-drained soils were not common in the county; therefore, only soils of fair to intermediate drainage in the Memphis and Loring series of the uplands and the Collins and Falaya series of the bottomlands were selected for testing. For each of the four series, six test sites were randomly picked from more than 200 selected locations on the soil maps. The locations of the sites are shown in fig. 1. All sites were nonforested so as to minimize the influence of vegetation in the analyses.

Layout

10. Sites ranged from 100 to 540 ft in length, as determined by the distance between soil map boundaries, and were 30 ft in width. The length of the site was oriented upslope in the uplands, and between the drainage channel and the foot of the uplands in the bottomlands. The site layout is shown in fig. 2. The smallest test area, the row, was established across the width of the site, parallel to the contour of the terrain. Five

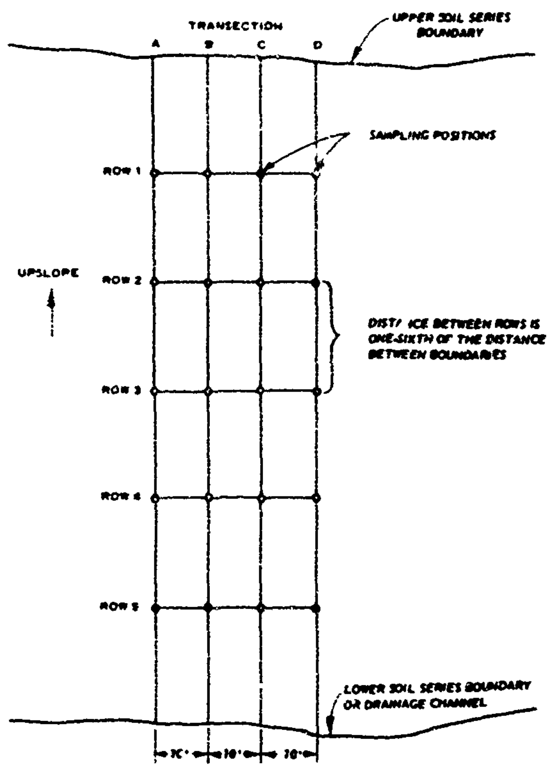


Fig. 2. Site layout

equidistant rows were established at each site, with spacing between rows governed by the site length. Four sampling positions (A, B, C, and D) were located 10 ft apart along each row.

Description

11. The locations and descriptions of the test sites including notes on topography, drainage, vegetation, and land use are given in table 1. Photographs of the sites, inset soil survey maps of areas of 1/2-mile radius around the sites, and the orientation of the sites are shown in plate 1.* More than 50 percent of the areas are mapped as soil series complexes of two or more dominant soil series. For example, 90 percent of the area surrounding site M VIII, a Memphis soil, was mapped as soil complexes. Macrogeometry and microgeometry of the test sites were described by the Geology Branch of the WES, using semiquantitative techniques devised by them.[5,6]

Selection of Test Plots

12. During sampling at the sites it became obvious that there were inclusions of soil other than that of the mapped soil series. The inclusions were not unexpected since small areas of unlike soils are difficult, if not impossible, to delineate and show at the scale of the soil survey maps. To determine the prevalence and nature of these inclusions, the soils were identified in the field by row, and the series identifications were changed where necessary.** Each two or more rows at a site of the same soil series identified in the field were grouped together for analysis and designated as a plot. Rows of a plot were not necessarily adjacent. Thus, a site identified in the field as a single soil series consisted of one plot; another site identified in the field as two soil series consisted

* The soil maps were taken from unpublished field sheets of the standard soil survey conducted by the Soil Conservation Service of the U. S. Department of Agriculture. Subboundaries separating classes of erosion and slopes are not shown. The results of the soil survey and the maps were published subsequently in 1964.[4]

** Identifications were made by Mr. Y. H. Havens, State Soil Correlator, Soil Conservation Service, Jackson, Mississippi.

of two plots. A cross-reference of soil series by sites and plots is shown in table 2. Field identifications were not made at five sites because the sites or access avenues to the sites were inundated at the time the identifications were made; of the remaining sites the series identifications were changed for 36 of the 95 rows, resulting in a grouping of soils into 23 plots, each with two to five rows. Single rows of a field-identified soil series were not designated as plots and were not included in plot and row analysis. In the uplands the major changes of the field identification were the delineation of areas of alluvial fill and the Henry series from areas mapped as Memphis. In the bottomlands, field identification of Collins and Falaya frequently differed from map identifications. The Hymon series was identified from soils mapped as Collins. Two different soil series were identified at each of four sites.

Data Collection

13. Samples were collected once at a site to obtain data on the static properties of the soil; four visits were made to obtain data on the dynamic properties of the soil for a range of weather conditions. Data were obtained from each of the 20 sampling positions at a site. Tests on successive visits followed a preset pattern that included moving the sampling position one pace from a previous location to preclude testing soil that had been disturbed in a previous test.

Static properties

14. One-pint bulk samples were taken from the surface to 6-in. and 6- to 12-in. layers and analyzed following standard test procedures,[7] for liquid and plastic limits, specific gravity, and grain sizes. Soil cores were taken with the modified San Dimas soil sampler in 3-in. vertical increments from the surface to a depth of 12 in. and used to determine dry density and soil moisture content at saturation, 0.015-, 0.03-, and 0.06-atm tensions.[8,9]

Dynamic properties

15. For those properties that vary with time, sampling and

measurements for a given visit to all sites were obtained as quickly as possible to prevent inconsistencies in test results that could result from interim drying or wetting of the soil. Samples for moisture content were taken from the surface to 6-in. and 6- to 12-in. layers, and a remolding index test was conducted on a sample from the 6- to 12-in. layer. Cone penetrometer measurements were taken at 3-in. vertical increments from the surface to 18 in. It was necessary to measure strength when the soil was fairly moist to be within the range of the test instruments. The first winter season was dry, and although two visits were made, the soil was too firm to obtain a sufficient number of strength measurements for analysis. Following a heavy rain in April, another visit was made (visit A). To assure getting data from firm soils, a 0.2-sq-in. cone penetrometer was used. Because of the dry condition experienced on previous visits, no attempt was made to measure moisture contents or take remolding index samples from the 6- to 12-in. layer. In late February of the second winter, a full round of testing was accomplished (visit B). A few days later a 5-in. rain occurred, and an abbreviated set of tests was conducted for check purposes (visit C). Three cone penetrometer measurements were taken at the A position of all rows, and moisture and remolding index samples at the A position of rows 1, 3, and 5. A final visit (visit D) was made in May to collect data for drier conditions. Sampling was the same as on the third visit, except that moisture samples were taken at position A of all rows.

16. Sampling and measurements followed standard test procedures.[1] Moisture contents were determined by oven-drying the soil to a constant weight. For the surface to 6-in. average cone index, the surface, 3-, and 6-in. readings were averaged; for the 6- to 12-in. average cone index, the 6-, 9-, and 12-in. readings were averaged.

PART III: ANALYSIS

17. A small area, considered uniform from a trafficability standpoint, varies because of point-to-point differences in soil materials and moisture content; however, for practical purposes, the area is considered to be of one kind or under one condition of the soil. In a larger area, variation is generally greater because of a gradual change in soil material or condition across the area, or inclusion of different kinds of materials or conditions. For trafficability purposes, it is desired to delineate between areas of relatively uniform soil material or condition. In this study, data of soil properties meaningful to trafficability were grouped by soil series and layer, and by topography, site, plot, and row, and analyzed to determine the variability for areas differing in size. Basic data obtained in this study are given in detail in Appendix A.

Variation by Soil Series

18. One means of distinguishing soil kinds is by soil series, in which soils are grouped pedologically, according to similarities in properties, layer, and parent material. This description is widely used in agriculture and is the basis for delineating soils on most soil maps, so the logical start in the study of variability was to test the usefulness of series as a means of differentiating trafficability conditions. Data from soil series identified from maps (at sites) and from soil series identified in the field (at plots) were analyzed to determine the differences of soil properties for each grouping.

Soil series identified from maps

19. The soil series identified from maps included Memphis and Loring in the uplands, and Collins and Falaya in the bottomlands. An analysis of variation of soil properties between series was compared with variation between sites within series.[10]

20. Soil properties, including grain sizes, plasticity, specific gravity, density, and moisture content at 0.06-atm soil moisture tension, were analyzed by 6-in. layers. Results, given in table 3 under "Series

Identified from Soil Maps," include mean values for each soil series, derived from average site values, and the standard deviation of the site values. The probable significance of differences between series values for each property was determined from the statistical F-value; i.e. the ratio of the variance between series to that between sites within series.[11] For example, the average values of sand content for Memphis, Loring, Collins, and Falaya soils are 12, 10, 15, and 12 percent, respectively, whereas the standard deviation of a site value within any series is ± 1.7 percent (table 3). The F-ratio of variances is not significant (NS), having a value of 1.44, whereas a minimum F of 2.74 is needed to show a significant difference among series; i.e., the spread of values in sand content between series is small compared to the variability between sites within series.

21. The values for sand, silt, fines, and plastic limit did not differ meaningfully among soil series (see table 3). However, differences in values of clay content for the 0- to 6-in. and 6- to 12-in. layers, and liquid limit and plasticity index for the 6- to 12-in. layer, are indicated between uplands and bottomlands soils rather than by series; the uplands have higher values than those of the bottomlands. Differences also exist in dry density and soil moisture content (0.06-atm tension) values, primarily between the Falaya bottomland and Loring upland soils. However, the Collins bottomland and Memphis upland soils do not differ in these properties. Cone index and moisture content data are not shown here because they had not been collected at this stage of the analysis.

Soil series identified
from field observation

22. Analysis by static properties. A second analysis was made using data for series identified in the field. Results, shown in table 3, under "Series Identified from Field Observations," are essentially the same for the Memphis-Loring upland soil series and Collins-Falaya bottomland soil series as in the analysis of the soil series identified from maps. Statistical analyses for silt, fines, and plastic limit were not made because the analysis of mapped soil series had shown that these properties were extremely uniform; the similarity of series mean values may be noted in table 3. Also, as in the analysis of series identified from maps,

differences occur in clay contents, liquid limits, and plasticity indexes, particularly in the 6- to 12-in. layer. Clay contents in the 6- to 12-in. layer of the Memphis and Loring upland soils averaged 23 percent; those of the Collins and Falaya bottomland soils averaged 12 percent. The liquid limits of the upland soils averaged 43 percent; those of the bottomland soils averaged 32 percent. The plasticity indexes of the upland soils averaged 19 percent; those of the bottomland soils averaged 7 percent. Thus, distinct differences were again indicated between Memphis-Loring upland and Collins-Falaya bottomland series groupings for soil properties that are generally used in soil classification. The soil property values of alluvial fill and the Henry series in the uplands were different from those of the Memphis and Loring series from which the soils were separated, and were similar to the values for bottomland Collins and Falaya series. The Hymon soil, not of pure loess origin, had a higher sand content than the others.

23. Analysis by dynamic properties. Surprisingly, cone index showed no statistically significant differences between series for either soil layer on any sampling visit. Hence, even though the soil series were correctly identified, the series designation was not useful for differentiating these loess soils by cone index. Some trends were evident, however. The strengths of the upland Memphis and Loring series were higher than those of the bottomland Collins and Falaya series at the less moist conditions (on visits A and D), but were almost the same at the more moist conditions (on visits B and C). Also, soils of the alluvial fill and Henry series, that had been separated from the upland Memphis and Loring series, had consistently low strength, usually lower than the bottomland soil series on all visits.

24. Moisture contents differed significantly between series, primarily in the surface to 6-in. layer. Bottomland Collins and Falaya soils had higher moisture contents than the upland Memphis and Loring soils, but at the more moist conditions of visits B and C, differences were small. Moisture contents of the alluvial fill and Henry series of the uplands were as high or higher than those of the bottomland soils on all visits.

25. On the basis of data from the four visits, it can be concluded

that cone indexes of soil series of intermediate drainage are not different. However, lower cone indexes are indicated for soil series with poor drainage than for soil series of intermediate drainage. The analysis shows that even though differences in physical properties (including moisture content) of the soil may occur between series, there may be no meaningful differences in cone index. This statement does not preclude the possibility that strength differences in loess may be differentiated on some basis other than pedological soil series, or that soil series classification may be useful for differentiating strengths of soils from diverse parent materials.

Variation by Plots and Rows Within Uplands and Bottomlands

Division into groups

26. An analysis of variance by plots and rows was conducted on Memphis, Loring, Collins, and Falaya series identified in the field. The other field-identified series were not included because the data for these soils were insufficient for proper analysis. The nine plots of Memphis and Loring and the ten plots of Collins and Falaya were grouped into uplands and bottomlands, respectively. This grouping simplified calculations and was deemed proper because previous analysis showed a similarity of properties between series within each of these groups (see paragraphs 21 and 22). Results of the analysis are given in table 4.

Variation by plots

27. Analysis by static properties. The data show differences in mean clay contents, liquid limits, and plasticity indexes between uplands and bottomlands of the 6- to 12-in. soil layer similar to those found in the analysis by series. However, significant differences in those properties also occur between plots within each group, with the exception of liquid limit in bottomlands. For the surface to 6-in. layer, as in the analysis by series, no differences occur between groups for liquid limit and plasticity index; however, differences again occur between plots within each group. Differences in sand content, dry density, and moisture content at 0.06-atm soil moisture tension were recorded between plots within each group, but only small differences were found for specific gravity. Silts,

fines, and plastic limit were not tested because the small range in plot values precluded any significant difference between plots. In some instances, differences between plots were greater than those between upland and bottomland groups.

28. Analysis by dynamic properties. Highly significant differences in cone index and moisture content were found between plots in both groups for each of the visits.* The differences in cone index between plots contrast sharply with the findings in the analysis by series (see paragraph 23). Also important is the similarity in the means and ranges of cone indexes and moisture contents between plots of uplands and plots of bottomlands for each of the visits. The range in cone index of bottomland plots overlapped that of the upland plots except for the less moist soil conditions of visits A and D, when some of the upland plots had higher strengths. The overlap of values in ranges of moisture contents between uplands and bottomlands was not as inclusive as that for cone indexes, but was still considerable when compared to the discrete ranges for clay, liquid limit, and plasticity index in the 6- to 12-in. layer.

Variation by rows

29. Data from rows within plots were analyzed with the variance attributable to plots excluded (table 4). For most properties, appreciable differences occurred between rows of the uplands and between rows of the bottomlands. The ranges of cone index values of the two groups were similar on all visits, and the mean strengths were about the same on visits B and C, but were somewhat higher in the uplands on visits A and D. The pattern of differences between rows was the same as between plots except that values for the rows exhibited more overlap than those for the plots in the 6- to 12-in. layer for clay content and liquid limit. Row data had a wider range than plot data and the distinction between uplands and bottomlands was not as good. The data indicate that trafficability cannot be discretely quantified by soil series designation or upland-bottomland groupings because of the large cone index variability of plots and rows within the larger units.

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* Moisture contents for visits C and D were not included in this analysis because sampling was not complete on all rows.

Variations of Plots and Rows

Comparison of plot cone indexes

30. The array of cone index values for all plots regardless of series and upland-bottomland groupings was next examined. Cone index values for the four visits were averaged, and the array arranged in order of increasing values. Visit values were graphed in the same sequence (plate 2). Some irregularities in visit values are apparent, but in general, the progression for each visit follows that of the average, showing the consistency of plot differences irrespective of time of sampling. The general intermingling in the array of plots irrespective of series and upland-bottomland groupings reveals why no differentiation by series or groups was found. Three Loring plots in the upland (L1, L2, and L4) had high strengths, but the next plots (F2 and C2&F7) of slightly lower strengths were bottomlands. Of the seven weakest plots, five, including one Loring, were uplands. However, of these, two plots of alluvial fill and one plot of the poorly drained Henry series were inclusions that had been separated from the mapped Memphis series. A true Memphis soil also occurred in this group.

31. Two of the four sites, each of which was divided into two plots after field identification of the soil, showed such similar cone indexes throughout the site for the four-visit average that the plots within each were recombined for this part of the analysis, namely plots C3 with F6, and C2 with F7. Plots of the other two sites had distinct cone index differences; the second weakest plot, AF2, was separated from the seventh strongest plot, M4, and the third weakest plot, HN1, was separated from the strongest plot, M3.

Relations between cone index and other soil properties by plots

32. Analyses were made to determine the relation between plot cone indexes and other soil properties of the plot, including dry density, moisture content, plasticity index, and clay content, in the 6- to 12-in. layer. The relations are shown in plate 3. Moisture contents and cone indexes were averaged for all visits to a plot, and each average was

used to characterize the plots. Dry density showed the best probable correlation, exhibiting high strength at high density, but the range in values was small (0.11 g per cc). Moisture content showed poorer correlation (significant at 5 percent level), but with a large range of values (from 23 to 31 percent) and was inversely related to cone index. Correlations were poor with plasticity index (significant at 20 percent level), and clay content (not significant at 20 percent level) and with other soil properties including liquid limit and silt content (not shown).

33. Although it is well established that grain sizes and plasticity constants are related to soil strength, the poor correlations of these properties indicate that they cannot be used to explain strength differences between plots in this study; their effects were secondary to those of such properties as moisture content and dry density. The irregularities in the trends of the arrays of plot values occurred whether correlation was good or poor, although they were more pronounced in the poor correlations. Why upland plots M1 and L3 have the normally low strength of bottomland soils but other soil properties characteristic of the upland soils, and why bottomland plots C2 and F7 and F2 have the normally high strengths of the uplands are not explained completely by moisture content or dry density data. The implication is that other factors not defined in this study contribute significantly to the variation.

Comparison of row cone indexes

34. The analysis of variance of soil properties showed highly significant differences between rows. However, the analysis did not indicate which rows were different or the persistence of difference with time, so variation by rows was examined in more detail. For the first comparison, rows of a plot were ranked from 1 (weakest) to 5 according to increasing average strength for all visits. Then rows of a given rank from all the plots were averaged for each visit (plate 4). A consistent difference in cone index is found between the high- and low-strength rows for all visits; differences are indeterminate for intermediate rows.

35. The cone index of the lowest strength row was not always statistically different from that of the highest strength row in a plot or from the plot average of the remaining rows, so a pooled variance based on all

visits (derived from pooled standard deviation in table 4) was used to select extreme rows (i.e. those with statistically different high and/or low average cone indexes) in each plot. Only three rows, AF1 row 3, C3 and F6 row 3, and HY1 row 2, had higher values than the plot average of the remaining rows, whereas 13 rows had lower values. Two rows with low strengths were found in each of three plots, F2 rows 2 and 3, L2 rows 2 and 5, and L1 rows 2 and 3. Soft areas occurred in a plot far oftener than did firm areas and were found throughout the array, although the strongest plots had the double soft rows. Soft rows were found at any row position. The average difference between the low-strength row and the plot average of the remaining rows was 93 CI; the median difference was 63 CI. Either difference is appreciable in terms of trafficability.

36. The cone index values of 10 plots with low-strength rows were plotted by visits in plate 5. The data show a consistent difference in cone index between the average for the plot, excluding the extreme rows (described in paragraph 35) and the low-strength row. Individual measurements of the low-strength row generally cluster about the row mean, showing that all points in the row were uniformly low in strength and the low value of the mean was not caused by a few erratic values. Some individual measurements in the low-strength rows were higher than plot averages on visit A, but not on visits B, C, and D.

Relations between cone indexes
<u>and other soil properties, by rows</u>

37. Analyses were made to determine whether the cone indexes of low-strength rows would correlate with other soil properties of the row. The procedure followed that relating plot cone index to other soil properties, discussed in paragraph 32, except that the cone index of the low-strength row was compared with the average cone index of the plot excluding the extreme rows. The B, C, and D visit values of cone index and moisture content were averaged and used as area indexes of strength and moisture, respectively. The relations of cone indexes of low-strength rows and of cone indexes of plot averages with other soil properties including dry density, moisture content, clay content, and plasticity index were similar to those found in the previous analysis of plots (see plate 6). A good

positive correlation occurred between cone index and dry density; a good inverse correlation occurred between cone index and moisture content; and no relation existed between cone index and clay content or plasticity index.

38. When average plot values (extreme rows excluded) were compared with the low-strength row values, the row value of dry density was always lower than that of its plot and the row value of moisture content was higher than that of its plot with one exception (plot F1). No pattern appeared between plots and rows for clay content and plasticity index. The differences among row strengths, like the differences among plot strengths, cannot be ascribed to differences in the grain size or plasticity of the soil, but must result from differences in density, moisture content, and other factors, such as those governing reception and retention of water, state of packing, structure, etc. The low-strength row is a small areal unit distinct from the average of the rows in the plot.

Relation of cone index and moisture content

39. In the analysis for correlations between cone index and moisture content of plots and rows previously discussed, values for the visits were averaged to provide one value for each area irrespective of time. In this analysis, soil strength-moisture relation is based on data averaged for the plot for each individual visit. The graphs of cone index versus moisture content for the 0- to 6-in. and 6- to 12-in. layers show inverse relations (plate 7). The spread of values at a given moisture content (about 200 CI for the surface to 6-in. layer and about 150 CI for the 6- to 12-in. layer) is too great for meaningful grouping of these loess soils together as one trafficability unit. Grouping by soil series for the 6- to 12-in. layer (plate 8) shows more closely defined relations, especially for the Memphis and Loring series. However, the spread of plot values even for a given visit (ranging about 100 CI) indicates that additional criteria are needed to accurately differentiate areas of dissimilar cone indexes within areas of the same series on the same day. The number of visits to a plot were too few to truly determine soil moisture-strength relations.

Remolding index variation

40. Only 200 remolding tests were made, compared to nearly 1000 cone index tests, because the soil was generally too firm to permit insertion of the remolding sampler. The data were not only sparse, but they were biased also because only the weak spots were tested. One hundred sixty-one of the tests were made on visit B, and 71 of these were on Falaya plots; only 25 tests were made on visit C and only 14 tests were made on visit D. A rigorous analysis could not be made because of the data limitation and bias; nevertheless, some measure of variability was obtained.

41. Data at all four sampling positions in a row, used for analysis of variance between rows, were collected from only 31 rows on visit B; 15 of the rows were Falaya. A difference in remolding index between rows was found. The standard deviation was ±0.12 RI for a sample within a row, a measure of variability in a uniform area of these loess soils. When remolding index data were analyzed as individuals, irrespective of rows, the standard deviation was ±0.16 RI and the mean was 0.47 RI.

42. Data from the other 76 tests, from rows with less than four remolding index tests, were grouped by visit, series, and then by all tests together, and analyzed. The results and those of an analysis of data from all 200 tests are as follows:

	No. of Samples	Mean Remolding Index	Standard Deviation ±
Visit			
B	37	0.53	0.16
C	25	0.55	0.21
D	14	0.69	0.34
Series			
Alluvial Hill and Henry	23	0.48	0.29
Memphis and Loring	20	0.63	0.17
Collins, Falaya, and Hymon	33	0.59	0.18
All samples, <4 sampling positions/row	76	0.57	0.23
All samples	200	0.51	0.20

The mean remolding index is highest for the drier soils of visit D, and the variability of the soil for this visit is proportionally higher. Although the alluvial fill-Henry group had the lowest mean remolding index, it had the largest range of values; seven samples were less than 0.25 RI and five samples were more than 0.60 RI, including one with 1.68 RI, the highest in the study. The upland (Memphis and Loring) group had about the same mean remolding index and standard deviation as the bottomland (Collins and Falaya). The variation of all samples was almost twice that within rows.

43. The plot averages of remolding index were graphed versus those of moisture content for all visits (plate 9) and show an approximate inverse relation. Similar graphs of remolding index versus dry density, clay content, liquid limit, and plasticity index were made, but no trends were indicated. Plot and row differences could not be determined from these data.

Influence of Rainfall, Terrain, and Other Factors

44. Results showed that cone index values of small areas, such as rows or plots, could not be applied with reasonable accuracy to large areas, designated by soil series or upland-bottomland groups, due to the large and overlapping ranges in values for the small areas. Furthermore, the soil classification parameters could not be used to differentiate the high-strength from low-strength areas; clay content and plasticity index did not correlate with strength differences among plots or rows, even though these properties differed as much as 15 percent among plots or rows. The influence of these properties on strength apparently was masked by more dominant influences of other factors. Significant moisture content differences were found for certain plots and rows irrespective of soil series. Since moisture content correlated with strength, moisture differences within a plot are undoubtedly one cause of the strength variations in plots and rows. Questions arise as to why the moisture differences existed, how the moist spots can be ascertained and accounted for in trafficability estimations across an area, and whether factors other than moisture contribute materially to the strength differences.

Moisture conditions at sampling

45. Wetting or drying during sampling can produce differences in soil moisture and strength that would mask the inherent variability between areas. To minimize these effects between sites for a particular visit, sampling was accomplished in one day with no rainfall, and in winter or spring when the rate of drying is small. The moisture condition can be considered the same throughout the testing area (although moisture contents were not) as sampling progressed during a visit day.

Antecedent rainfall

46. The effect of antecedent rainfall on plot strength differences is believed to be small, since sampling was done in late winter and spring when rains are general and soils are near the field-maximum moisture content. There is no positive assurance that antecedent rainfall was uniform, since rain gages were not maintained at the test sites; however, at weather stations 10 to 30 miles away bracketing the test area, rainfall measurements were relatively uniform for 19 days preceding each visit. The amounts, tabulated below, indicate that the entire area, including the test sites, received fairly uniform precipitation.

Rain Gage Station	Location of Station from Sites	Rainfall, in. Visit A	Visit B	Visit C	Visit D
Germania	North	5.22	2.20	6.72	2.78
Vicksburg	West	5.27	2.84	5.46	3.93
Oakley	East	3.41	2.47	6.61	3.74
Utica	Southeast	4.69	1.87	5.97	2.95
Port Gibson	South	4.21	1.97	4.38	3.97

47. Plot data substantiate the uniformity of precipitation. Sites were generally located in two clusters, 18 miles apart (fig. 1) with a few sites outlying from them. Strength and moisture differences between plots less than a mile apart within a cluster were as great as between clusters, and large differences occurred between plots at the same test site, 50 to 100 ft apart. Thus, strength differences did not exhibit an areal difference that can be attributed to rainfall pattern.

Water table

48. Part of the moisture differences may arise from differences in

depth to shallow water tables, which were not considered. However, the differences between plots were as great in the uplands as in the bottomlands; the upland soils, except for the Henry plot, were moderately to well drained, supposedly with no influencing water table within the surface 4 ft of soil.

Density and structure

49. The moisture differences did not explain all the strength differences between rows and plots; the low-strength rows had lower strengths than the balance of the plots at comparable moisture contents. Soil density was associated with strength, shown by the positive correlations for plots and rows. Density differences are due in part to structure of the soil (i.e. the arrangement, size, and durability of the clumps or aggregates of the soil) but structure may influence strength directly. Structural differences in the surface layers could have originated by several means. The structure of recently transported material is quite different from that of soil developed in place. The transported material occurs in the bottomlands, but can occur in fill areas of the uplands. These fills may have the same texture, plasticity, and even moisture content as the mature soil, yet strength may differ due to structural differences per se. Soil layers or horizons, such as the surface A horizon and subsoil B horizon, differing in structure, density, and other properties may occur at the same depth due to differential erosion or to development of different thicknesses in a horizon between rows or plots. Structural differences may also result from differing cultural practices. A pasture developed from a woodland can differ from a pasture developed from an old field. Soil structure was not determined in this study because quantitative procedures for determination were not available.

Organic matter

50. Organic matter content, which is not generally considered in WES studies relating properties of soil to strength, can influence soil strength directly or indirectly through its effect on moisture content, plasticity, and structure. The organic content can change with cultural practices and over short distances. Threshold values and quantitative relations of the effect of organic matter on soil strength are unknown.

Terrain

51. The terrain configuration can influence the reception and retention of water with runoff from high spots to low spots. Thus, moisture content differences could occur even though the rainfall pattern was essentially the same over the area. An analysis of the terrain configuration may indicate areas of differential erosion and deposition that relate to differences in soil structure and organic content.

52. Topographic position. A qualitative topographic position classification used in trafficability studies recognizes uplands, terrace, and bottomlands with subdivisions of flat, depression, upper slope, and lower slope. The divisions are not well defined, and classification, in many cases, depends on the judgment of the field observer. In the study reported herein, some sites were 540 ft long and included more than one topographic position. Classification at all sites was done by row, and rows of different topographic positions were examined for differences. The flat areas of the uplands tended to have the lowest strengths; no other trend could be discerned. Most Collins and Falaya rows were bottomland flats, so no differential grouping could be made. This study indicates that a more rigorous definition of classes is needed to enhance the utility of this classification for trafficability purposes.

53. Terrain geometry. The Geology Branch of WES classified microgeometry of each site for trafficability use, using 50 ft of the length and the full width of the site.[6] Macrogeometry was also classified within a half-mile radius of each site. The relations between cone index and microgeometry and macrogeometry factors are considered here.

54. Microgeometry factors included overall slope, number of slope reversals, modal relief differences, and surface length increase. Cone index of the row nearest the geometry profile was used as a strength measurement. Some trends were shown, as for modal relief differences (plate 10), but scatter generally was wide.

55. Macrogeometry classification was based on terrain conditions within a half-mile radius of the sites (plate 1), so both row and plot strengths were considered. The factors classified included plan profile, characteristic slope, and characteristic relief. An additional factor,

occurrence of slopes steeper than 50 percent, was not used since most sites were in the same slope occurrence class. The macrogeometry factors showed trends with cone index as good or better than the trends for microgeometry factors (plate 10). The broad, flat areas with low relief had lower strengths than the more dissected areas in both uplands and bottomlands, but the point scatter was wide for each of the factors. The relation between row and plot cone index values was better than that between cone index of plot and any of the microgeometry or macrogeometry factors. Results indicate that these factors can aid in estimating trafficability conditions, but they must be improved, perhaps by using the mesoscale, before they can be of any value in accurately predicting trafficability. The terrain surrounding the area of concern also must be defined with reference to its influence on trafficability, though not necessarily by a fixed dimension, and not necessarily equally in all directions.

56. Terrain and plot values. Field notes, topographical maps, and aerial photographs were examined to obtain data on terrain features on and surrounding the plots. The data were compared with cone index of the plots to determine the influence of the features on trafficability. Features studied were distance to hillcrest above row 1; relief difference above row 1; convex or concave curvature of plot surface compared to surroundings; degree of erosion; area of watershed above site; valley floor width; and creek bed depth. Data were listed in order of increasing cone index (table 5). Examination of the data shows that in the uplands curvature of the area and strength are related, with strength lower in concave areas than in convex ones. In the bottomlands, sites in the lower parts of large watersheds had lower strength than sites in the upper reaches, with little drainage area above them. Other features such as degree of erosion, valley width, and creek depth exhibited some trends. Thus, some terrain features can be used to distinguish kinds of trafficability conditions. When they are recognized and taken into account, better deployment of vehicles and prediction of their movements will be possible.

57. Terrain and low-strength row values. Possible influence of features of terrain on extreme low-strength rows was considered next. Differences in strengths between rows could not be resolved from examination

of maps and photographs, so field notes were used to provide information. Data were sparse, so only general observations are offered to explain the low-strength rows. Row M1-5 occurred at the lower end of a concave slope. The soil of row AF1-2 consisted of deep local alluvium which was upslope from shallower local alluvium, resulting in conditions conducive to the development of a perched water table that may have influenced the strength of the soil. Row C3&F6-4 was possibly a filled old drainageway. Row F1-1 was near the toe of a slope and had overlying alluvial fill, but the alluvial fill was not deep enough to classify the row as such. Row L1-3 was a concave row in an otherwise convex plot. Row L5-5 may have been upslope from an old erosion-control terrace. Information was insufficient to suggest a cause for the low-strength rows of the other four plots. Although terrain features noted herein generally are too small to map, they should be observed and considered in any trafficability analysis because they can immobilize a vehicle. The development and use of a suitable terrain geometry classification may have the most immediate promise for differentiating trafficability conditions within areas considered uniform in soil type but variable in soil strength.

Sampling Requirements

58. The number of samples required to test areas of soil considered uniform should be sufficient to provide values within limits of a desired accuracy. For trafficability purposes, areal units for testing and application should be relatively uniform in strength. Data on soil properties used in estimating soil strength should be obtained from samples from the same areas. This study showed that neither series, upland and bottomland groupings of series, nor plots defined an area uniform in cone index. Because of the large variation in strength within these areal divisions, their use would result in large error in the delineation of trafficability conditions. Sampling requirements for these areas also would be large. The row was used for estimating sampling requirements. The 30-ft-long row, corresponding in length to test sites of previous moisture-strength studies, is a minimal size for sampling, approximating the length of most military vehicles.

Sampling by rows versus clusters

59. Row uniformity was checked using cone index measurements of the four visits. On visits A and B samples were taken at 10-ft intervals along the 30-ft row; on visits C and D three samples were taken in a cluster (within 1 ft of each other) at position A. The need to sample all plots within one day and the limited number of personnel available for testing prevented taking both cluster and row samples on the same visit, although this would have been desirable. Data from the upland soils (Memphis and Loring) and bottomland soils (Collins and Falaya) were used. Data were divided further into wet soil condition for visits B and C and moist soil condition for visits A and D.

60. To check consistency of variation between visits divorced from row or cluster effect, single samples from position A of all rows were analyzed (table 6). A difference in variation, expressed by standard deviations and coefficients of variation, occurred between wet and moist sampling conditions; however, with either condition variation was consistent between visits or between upland and bottomland positions. Next, the first three samples in a row were compared with the three in a cluster. The standard deviations of individuals in the triplicate sampling were very close to those of single samples, showing that the pattern of variation was the same. The between rows or cluster effect was next removed, so that variation within rows could be compared to that within clusters. The standard deviations and the standard error of means show that there was some increase in variability in going from the smaller area of clusters to the larger area of rows. The standard error of the bottomland soils increased from 12 to 18 CI on the wet soil condition visits, and from 27 to 39 CI on the moist soil condition visits. It should be noted that a twofold to threefold greater variability occurred between moist and wet conditions than between cluster and row sampling. Thus, the variability of the row can be used as a reasonable measure of the basic variability of these soils, although the basic variation of cone index is larger than desired (for triplicate sampling the standard error was about 16 units when wet and 38 units when moist).

Estimating number of samples

61. With knowledge of basic variation (i.e. the standard deviation or error mean square), a value for allowable error or desired accuracy, and the probability level for attaining that accuracy, the number of samples required to give an acceptable average value of a property can be calculated.*[11] The error terms were derived from pooled deviations (table 4) since the upland and bottomland groups did not differ in trafficability characteristics. The plot and row means of the soil properties varied as much in the uplands as in the bottomlands, and their ranges overlapped, so separate sampling plans were not prescribed.

62. The estimate for number of samples can vary considerably, depending upon the desired accuracy (i.e. allowable error) of the factor and the probability level for attaining that accuracy. A larger number of samples would be prescribed for a highly accurate average (i.e. within a narrow range) and for a high chance of success for the average to fall within the narrow range than for an average with a lower accuracy (i.e. within a broader range) and lesser probability. Also, for a given accuracy and probability, a highly variable material (i.e. one with a high standard deviation) would require more samples than a more uniform material. The estimate for number of samples must consider both the desired result and the nature of the material; a close tolerance for highly varied material would lead to a prohibitive sampling requirement.

63. Cone index and moisture content measurements in natural soils vary more than those for grain size, plasticity, and other static properties. A lesser probability level of 20 percent was used for these dynamic properties compared to 5 percent for the static properties. This indicates that there is a 20 percent chance that the measured mean for cone index or moisture content will differ from the true mean by more than the desired accuracy, but only a 5 percent chance that the static properties will. The use of a lower order of probability for natural conditions that are inherently variable is accepted in various fields, e.g. weather and rainfall forecasting.

$$* \text{ Number of samples } (n) = \frac{[\text{probability ("t")}]^2 \times [\text{standard deviation } (s)]^2}{[\text{allowable error of factor } (L)]^2}$$

64. The desired accuracy for an average value of a factor for a row was selected considering what is meaningful and attainable. Cone index accuracy, the primary consideration for trafficability, was set at ±10 units. The magnitude of variation within the row (table 4) was too great to justify selection of a smaller value. In fact, variation of cone index on the moist soil condition visits was relatively high so that the accuracy range had to be increased to ±20 units to keep the required number of samples reasonable. Cone index was above 200 on the moist soil condition visits, so the lower accuracy would not be critical. A 1 percent accuracy was selected for moisture content because previous studies have shown that for many soils a change of 1 percent results in a change of 20 CI. Three percent was considered a reasonable degree of accuracy for most static properties and 0.04 g per cc for dry density, since this is equivalent to a pore capacity change sufficient to retain 1 percent moisture for the average soil.

Sampling requirements for rows

65. The estimates of the number of samples for cone index varied by visit and soil layer (table 7). About 10 samples were needed for the wet soil conditions of visits B and C, but more were required for the moist conditions of visit A, even though the range of allowed accuracy was greater. The number of samples for remolding index was three for an accuracy of ±0.10, and 10 for an accuracy of ±0.05. The latter accuracy is not unrealistic; a difference of 0.10 RI is 10 RCI at 100 CI. The data collected for this study provided little opportunity to evaluate the number of moisture content samples since rows did not have replicated samplings on visits C and D. However, for visit B, the required number of samples for both layers (5) was less than half that required for cone index (11 for the 0- to 6-in. layer and 18 for the 6- to 12-in. layer). About five were required for most static soil properties. In current studies, three samples are taken—at the top, middle, and bottom sections of the plot—and composited as one sample for analysis. Estimates of sample number for dry density and moisture tension, determined on core samples of natural soils, ranged from two to six. At present, three samples are taken for each layer. This study shows that the number of samples required to properly

characterize loess soils are greater than are currently being taken in trafficability prediction studies. A need to increase the sampling intensity by 30 to 60 percent to attain a minimum desired accuracy is indicated.

Applicability of These Results to Other Soils

66. The soils investigated in this study were derived from loess, which is one of the more uniform soil parent materials. Mean values by grain size, plasticity, and density (table 3, field observations), were practically identical between series and between layers except for the 6- to 12-in. layer of the Memphis and Loring upland soils. The higher clay contents, liquid limits, and plasticity indexes of these soils reflected the genesis and illuviation of clay from the upper A to the B horizon. In contrast, strength measurements varied, which can be partly attributed to local differences in moisture content. These local differences are not unique to loess, but will occur in any soil, regardless of parent material. In comparisons of diverse soils, such as silt with clay, expected correlations of strength with grain size and plasticity may be poorer than anticipated, as evidenced in this study, because of the influence of other unknown factors. In other strength studies covering a variety of soils from locations throughout the United States, relations with the known physical properties were relatively poor. Obviously, other factors need to be defined to account for strength differences.

PART IV: CONCLUSIONS AND RECOMMENDATIONS

Conclusions

67. The following conclusions can be made from this study:

a. Neither map- nor field-identified soil series of moderate- to well-drained loess soil in Warren County, Mississippi, can be used to delineate with sufficient accuracy areas of uniform trafficability. Also, no distinction in trafficability can be made for these series grouped into uplands and bottomlands even though differences do occur in clay content and plasticity constants in the 6- to 12-in. layer (table 3 and pars. 21-25).

b. Inclusions of soils, different from those mapped and with lower strengths, were found within the mapped boundaries. These soils, recent alluvial fills and a poorly drained Henry series, covered areas of sufficient size to pose problems in trafficability and should be accounted for, even though some of these areas are too small to depict on maps (table 3 and pars. 12, 23-25).

c. The variation of soil strength and moisture content within small areas (plots and rows) was large and masked real differences that may exist between soil series or upland and bottomland series groupings. Because of the large variation, values derived from small areas cannot be applied to large areas with any degree of confidence (table 4 and pars. 28 and 29).

d. The cone index differences among plots and rows were significant and consistent for the four visits (plates 2 and 4, and pars. 30 and 34). These differences can be ascribed to differences in local conditions of terrain and soil, rather than to differences in rainfall patterns or other meteorological events (pars. 45-47).

e. Small areas of low strength were found as inclusions within larger areas of higher strength (plate 5 and par. 36). These low-strength areas are difficult to identify and explain because the soils are not pedologically distinct and do not substantially differ in grain size or plasticity from soils of the larger enclosed area (plates 3 and 6, and pars. 32, 33, 37, 38, and 44). A suitable terrain geometry classification may have the most immediate promise for identifying these small areas. Differences in the geometry of terrain are observable and suggest probable differences in the reception and retention of water which this study shows, by inference, to be factors that can account for soil strength differences. The terrain geometry also may indicate other

differences associated with surface water movement such as differential soil erosion and deposition that would result in possible differences in dry density, structure, and organic content of the soil (pars. 51-55).

f. Estimates of the number of samples required to provide reliable mean values for trafficability purposes, based on measurements within rows of relatively uniform soil, indicate that five samples should be taken for determination of the static physical properties, five samples for determination of moisture content, ten measurements for cone index, and ten measurements for remolding index. Ten remolding index tests will provide an accuracy of ±0.05 unit, whereas three samples will give an accuracy less than desired, i.e. ±0.10 unit (table 7 and par. 65).

Recommendations

68. The following recommendations are offered for guidance in future studies:

a. A terrain geometry classification system suitable for trafficability purposes should be developed.

b. Studies should be conducted to identify and evaluate the effects on trafficability of soil factors that have not been considered in WES trafficability studies, such as organic content, soil structure, and natural cementing agents.

c. The number of samples should be increased to five for static properties and to ten for strength measurements.

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Table 1

Location and Description of Test Sites

Site Designation	Location: Latitude	Location: Longitude	Orientation Rows 1 to 5	Distance Between Rows ft	Topography: Aspect	Topography: Position	Slope %	Drainage: Surface	Drainage: Internal	Vegetation	Land Use
Memphis Series											
M I	32°20'58"	90°43'18"	N 0° E	48.0	S	Upland ridge and slope	4	Medium	Medium	Grass and weeds	Idle field
M III	32°20'33"	90°42'38"	N 340° E	75.0	Level	Upland flat	<1	Medium	Medium	Grass and weeds	Pasture
M IV	32°22'30"	90°40'15"	N 180° E	55.0	N	Upland slope	2-9	Medium	Medium	Row crops	Cultivated
M V	32°20'54"	90°42'14"	N 100° E	52.0	W	Upland ridge and slope	2	Medium	Medium	Grass	Pasture
M VI	32°20'54"	90°42'22"	N 355° E	70.0	S	Upland flat and slope	0-2	Medium	Medium	Grass	Pasture
M VIII	32°27'24"	90°42'28"	N 315° E	35.0	SE	Upland ridge	3	Medium	Medium	Weeds and grass	Idle
Loring Series											
L I	32°08'36"	90°54'36"	N 50° E	60.0	SW	Upland ridge	2	Medium	Medium	Grass	Pasture
L III	32°08'34"	90°53'53"	N 315° E	75.0	SE	Upland upper slope	6	Good	Medium	Grass	Pasture
L IV	32°08'36"	90°53'51"	N 240° E	75.0	NE	Upland slope	6	Good	Medium	Grass	Pasture
L V	32°09'00"	90°54'27"	N 0° E	90.0	S	Upland upper slope	6	Good	Medium	Grass	Pasture
L VI	32°27'40"	90°40'50"	N 10° E	60.0	S	Upland upper slope	3	Good	Medium	Grass	Pasture
L VIII	32°10'10"	90°53'27"	N 225° E	55.0	NE	Upland upper slope	12	Good	Medium	Grass	Pasture
Collins Series											
C I	32°27'34"	90°41'15"	N 285° E	22.5	Level	Bottomland flat	<1	Poor	Poor	Grass and weeds	Pasture
C II	32°21'00"	90°40'02"	N 10° E	70.0	Level	Bottomland levee	1	Medium	Poor	Grass	Pasture
C III	32°21'06"	90°42'52"	N 245° E	55.0	Level	Bottomland flat	1	Poor	Poor	Grass and weeds	Pasture
C IV	32°10'42"	90°50'30"	N 110° E	50.0	Level	Bottomland flat	1	Poor	Poor	Grass	Pasture
C V	32°09'05"	90°54'09"	N 265° E	37.0	Level	Bottomland flat	1	Poor	Poor	Weeds	Idle
C VI	32°12'33"	90°49'42"	N 355° E	17.0	S	Bottomland flat	2	Medium	Poor	Grass	Pasture
Falaya Series											
F I	32°17'27"	90°42'20"	N 290° E	30.0	Level	Bottomland flat	<1	Poor	Poor	Grass, brambles, and saplings	Idle
F II	32°09'35"	90°54'22"	N 315° E	35.0	SE	Bottomland flat	2	Medium	Medium	Grass	Pasture
F III	32°09'45"	90°47'45"	N 65° E	30.0	Level	Bottomland flat	<1	Poor	Poor	Grain	Cultivated
F V	32°18'00"	90°42'08"	N 350° E	30.0	Level	Bottomland flat	<1	Poor	Poor	Grass, brambles, and saplings	Idle
F VII	32°23'12"	90°41'04"	N 0° E	20.0	S	Bottomland flat	2	Poor	Poor	Grass and weeds	Idle
F VIII	32°09'30"	90°54'33"	N 190° E	33.5	N	Bottomland flat	2	Medium	Medium	Grass and weeds	Cultivated

Table 2

Cross-Reference of Soil Series by Sites and Plots

Site No. for Soil Series Identified on Maps	Plot No. for Soil Series Identified in Field						
	Uplands				Bottomlands		
	Alluvial Fill	Memphis	Loring	Henry	Collins	Falaya	Hymon
Memphis Series							
M I	AF1	--	--	--	--	--	--
M III	--	M2	--	--	--	--	--
M IV	--	M1	--	--	--	--	--
M V	AF2 (2, 3, 4)	M4 (1, 5)	--	--	--	--	--
M VI	--	M3 (4, 5)	--	HN1 (1, 2)	--	--	--
M VIII	Not identified						
Loring Series							
L I	--	--	L2	--	--	--	--
L III	--	--	L5	--	--	--	--
L IV	--	--	L4	--	--	--	--
L V	--	--	L3	--	--	--	--
L VI	--	--	L1	--	--	--	--
L VIII	Not identified						
Collins Series							
C I	--	--	--	--	C2 (2, 3, 4)	F7 (1, 5)	--
C II	--	--	--	--	--	--	HY1
C III	--	--	--	--	C1	--	--
C IV	--	--	--	--	--	F3	--
C V	--	--	--	--	--	F5 (1, 2, 3, 4)	--
C VI	--	--	--	--	--	F2	--
Falaya Series							
F I	Not identified						
F II	--	--	--	--	C3 (1, 3)	F6 (2, 4, 5)	--
F III	Not identified						
F V	Not identified						
F VII	--	--	--	--	--	F1	--
F VIII	--	--	--	--	--	F4 (1, 2, 3, 4)	--

Note: Figures in parentheses refer to row numbers in plot. Plots with no row numbers listed contain five rows of same soil series.

Table 3

Soil Property Values for Soil Series

Soil Property and Unit of Measure	Series Identified from Soil Maps: Series Means from Site Values: Uplands: Memphis	Uplands: Loring	Bottomlands: Collins	Bottomlands: Falaya	Standard Deviation of Site Value	"F" Significance Series/Sites	Series Identified from Field Observations: Series Means from Plot Values: Memphis	Loring	Collins	Falaya	Alluvial Fill	Henry	Hymon	Standard Deviation of Plot Value	"F" Significance Series/Plots
0- to 6-in. Soil Layer															
Sand, %	12	10	15	12	1.7	NS	12	11	14	12	12	12	30	2.0	**
Silt, %	73	71	74	75	2.6	NS	72	71	75	76	76	75	61		
Clay, %	16	19	11	13	3.2	**	16	18	11	12	12	13	9	2.9	**
Fines, %	99	99	96	98	1.1	NS	99	99	98	98	99	94	82		
LL, %	35	36	34	39	3.1	NS	34	36	34	36	35	34	31	3.0	NS
PL, %	25	25	26	27	1.5	NS	24	24	27	27	27	26	25		
PI, %	10	11	8	11	2.8	NS	10	10	7	9	8	8	6	3.0	NS
Specific gravity							2.66	2.66	2.66	2.66	2.66	2.68	2.67	0.01	NS
Density, g/cc	1.44	1.46	1.42	1.34	0.04	**	1.46	1.45	1.39	1.40	1.38	1.43	1.41	0.04	NS
MC (0.06-atm ten.), %	28.1	27.5	29.5	32.8	1.5	**	27.1	27.5	30.0	30.2	30.8	29.3	29.3	1.2	**
MC, %															
At visit A							26.4	28.5	31.3	32.2	33.6	32.1	32.0	1.8	**
At visit B							28.2	29.5	29.3	31.2	33.6	31.4	32.4	1.8	*
At visit C							27.3	23.6	28.9	30.7	34.2	31.2	31.2	2.0	*
At visit D							22.5	22.2	25.6	27.8	30.0	32.0	28.9	2.2	**
CI															
At visit A							183	201	148	146	105	166	211	67	NS
At visit B							138	152	132	141	106	148	168	49	NS
At visit C							146	151	167	142	108	150	165	53	NS
At visit D							264	339	248	216	170	208	214	70	NS
6- to 12-in. Soil Layer															
Sand, %	10	9	15	12	2.0	NS	9	9	14	11	12	13	32	1.8	*
Silt, %	70	67	73	74	2.5	NS	68	67	75	76	74	68	58		
Clay, %	20	24	12	14	2.5	**	23	24	11	13	14	19	10	3.2	**
Fines, %	99	100	96	98	1.5	NS	100	100	98	99	99	92	81		
LL, %	40	42	32	35	3.3	**	44	42	32	33	31	34	26	3.8	**
PL, %	24	24	24	26	1.3	NS	24	24	26	25	24	24	22		
PI, %	15	18	7	10	4.6	**	20	18	6	8	7	10	4	3.5	**
Specific gravity							2.70	2.69	2.67	2.67	2.66	2.70	2.70	0.01	*
Density, g/cc	1.47	1.50	1.45	1.42	0.03	**	1.48	1.50	1.43	1.44	1.44	1.42	1.47	0.02	**
MC (0.06-atm ten.), %	27.5	26.7	28.5	29.8	1.2	**	27.3	26.9	28.8	28.8	27.2	29.0	29.0	0.9	*
MC, %															
At visit A	Not sampled														
At visit B							27.4	27.7	28.3	29.3	29.4	31.0	28.8	1.4	NS
At visit C							26.8	26.6	28.1	29.2	29.8	28.2	29.4	1.9	NS
At visit D							21.7	20.1	23.3	27.0	26.6	29.4	25.9	2.9	**
CI															
At visit A							296	323	210	240	173	166	223	100	NS
At visit B							183	204	231	201	152	[illegible]	202	56	NS
At visit C							184	207	201	195	150	128	173	52	NS
At visit D							383	458	312	297	254	238	275	101	NS

Note: NS, not significant at the 5% level.
* Significant at the 5% level.
** Significant at the 1% level.

Table 4

Plot and Row Mean Soil Property Values by Uplands and Bottomlands

Soil Property and Unit of Measure	Analysis by Plots: Uplands Plot Values Mean	Uplands Plot Values Range	Uplands "F" Significance Plots/Rows	Bottomlands Plot Values Mean	Bottomlands Plot Values Range	Bottomlands "F" Significance Plots/Rows	Analysis by Rows: Uplands Row Values Mean	Uplands Row Values Range	Uplands "F" Significance Rows/Samples	Bottomlands Row Values Mean	Bottomlands Row Values Range	Bottomlands "F" Significance Rows/Samples	Standard Deviation of Individual Measurements: Uplands	Bottomlands	Pooled
0- to 6-in. Soil Layer															
Sand, %	11	9-13	**	12	8-16	**	11	8-14	**	12	8-24	**	1.76	1.72	[illegible]
Silt, %	71	68-77		76	72-80		72	61-79		76	67-82				
Clay, %	18	11-22	*	12	9-15	**	17	9-30	**	12	8-21	**	4.75	1.49	3.52
Fines, %	99	98-100		98	95-100		99	98-100		98	89-100				
LL, %	35	29-38	**	36	33-43	**	35	28-42	**	[illegible]	32-45	NS	3.51	2.55	3.07
PL, %	25	24-26		27	26-28		25	23-28		27	25-30				
PI, %	10	3-13	**	9	7-15	**	10	0-17	**	9	5-18	NS	3.55	2.34	3.01
Specific gravity	2.66	2.64-2.68	**	[illegible]	2.64-2.67	**	2.66	2.64-2.68	**	2.66	2.61-2.67	**	0.012	0.005	[illegible]
Density, g/cc	1.46	1.43-1.50	NS	1.40	1.34-1.45	**	1.45	1.41-1.51	**	1.40	1.30-1.50	**	0.034	0.031	0.033
MC (0.06-atm ten.), %	27.3	25.6-28.1	*	30.1	28.5-32.0	*	27.4	25.1-29.9	**	30.0	[illegible]-32.4	**	1.24	1.31	1.28
MC, %															
At visit A	28.0	24.0-29.9	*	32.0	29.8-3[illegible].1	*	28.4	20.9-32.2	**	31.7	27.0-39.8	**	2.6	2.0	2.32
At visit B	29.0	25.8-31.9	**	30.6	27.7-33.6	**	29.2	24.1-33.3	**	30.9	27.2-36.6	**	1.6	1.7	1.65
At visit C	28.0	25.6-30.2		30.2	27.7-34.9		28.3	25.6-32.0		30.4	26.8-37.2				
At visit D	22.3	21.0-23.4		27.1	22.7-3[illegible].2		22.4	[illegible].7-28.6		27.4	21.2-34.7				
CI															
At visit A	193	86-293	**	147	65-235	**	186	[illegible]-420	**	149	57-290	**	54.0	41.4	48.1
At visit B	146	99-185	**	156	38-241	**	145	[illegible]-212	**	147	32-250	NS	25.3	26.0	25.7
At visit C	149	108-191	**	150	34-260	**	147	72-221	**	142	14-262	**	19.0	15.2	17.2
At visit D	305	179-379	*	226	75-338	**	310	137-533	**	213	56-379	**	40.9	27.9	35.0
6- to 12-in. Soil Layer															
Sand, %	9	8-11	NS	12	8-16	**	9	5-12	*	12	7-22	**	1.92	1.27	1.63
Silt, %	68	63-73		7[illegible]	73-78		68	59-78		75	68-81				
Clay, %	23	17-28	*	13	9-16	**	23	12-36	**	13	9-18	*	3.74	1.34	2.81
Fines, %	100	99-100		99	96-100		100	98-100		99	[illegible]-100				
LL, %	43	3[illegible]-48	**	33	31-36	NS	42	29-53	**	33	29-43	**	4.48	1.53	3.35
PL, %	24	23-26		25	24-26		24	22-27		25	23-27				
PI, %	19	11-24	*	8	6-12	**	18	6-28	**	8	4-17	**	4.39	1.[illegible]	3.35
Specific gravity	2.69	2.67-2.71		2.67	2.[illegible]-2.68	**	2.69	2.66-2.72	**	2.67	2.[illegible]-2.68	NS	0.010	0.006	0.012
Density, g/cc	1.49	1.46-1.53	*	1.44	1.[illegible]-1.47	**	1.49	1.41-1.55	**	1.44	1.3[illegible]-1.50	**	0.028	0.024	0.026
MC (0.06-atm ten.), %	27.0	25.6-28.9	**	28.8	27.5-30.[illegible]	*	27.0	24.8-2[illegible].9	**	28.7	2[illegible].3-30.7	**	1.08	0.88	0.99
MC, %															
At visit A	-------	-------	-------	-------	-------	-------	Not sampled	-------	-------	-------	-------	-------	-------	-------	-------
At visit B	27.6	25.8-31.1	**	29.0	27.3-31.2	*	27.7	24.7-33.8	**	30.0	23.9-34.4	**	1.6	1.6	1.6
At visit C	26.7	24.6-29.4		28.9	26.7-33.2		26.8	23.8-30.7		29.0	24.9-35.4				
At visit D	20.8	17.0-25.7		25.9	18.9-30.0		21.0	10.4-26.6		2[illegible].2	16.6-33.3				
CI															
At visit A	280	156-473	**	231	[illegible]-336	**	235	[illegible]-717		230	118-[illegible]	**	92.2	[illegible]	[illegible]
At visit B	195	130-248	**	210	[illegible]-291	**	194	104-298	**	2[illegible]	7[illegible]-[illegible]	**	32.9	33.2	33.1
At visit C	196	139-262	**	197	[illegible]-286	**	1[illegible]	114-3[illegible]	**	[illegible]	[illegible]-300	**	25.1	21.0	[illegible]
At visit D	424	223-561	*	302	171-439	**	418	1[illegible]-750	**	[illegible]	[illegible]-[illegible]29	**	53.9	47.1	[illegible]

* Significant at the 5% level.
** Significant at the 1% level.

Table 5

Cone Index, Moisture Content, and Terrain Information for Plots

Plot	Avg CI 4 Visits 6-12 in.	Avg MC, % 3 Visits 6-12 in.	Row Spacing ft	Plot Slope %	Distance Upslope from Row 1: Distance to Crest ft	Distance Upslope from Row 1: Relief Diff ft	Surface Curvature	Erosion
					Uplands			
AF2	164	30.1	52	2, 1*	100	5	Concave	Fill
HN1	170	29.5	70	0	On flat	0	Slight concave	None
M1	176	26.9	55	6, 3*	200	10	Concave	Rows 1&2 severe; Rows 4&5 none
L3	191	27.5	90	6, 2*	100	5	Concave	Severe
AF1	201	27.0	48	4, 2*	50	5	Concave	Fill
HY1	218	28.0	70	0, 2*	On crest	0	Flat to convex	None
M2	221	26.2	75	0	On flat	0	Straight	None
L5	262	24.4	75	4, 6*	75	5	Convex	Row 1 some; Rows 2-5 none
M4	283	25.1	52	2	On crest	0	Convex	Some
L2	332	23.8	60	2	60	0	Convex	Some to severe
L1	352	24.7	60	3	100	5	Convex	Severe
L4	354	23.5	75	6	300	10	Straight	Some
M3	364	23.1	70	2	150	5	Convex	Severe

Plot	Avg CI 4 Visits 6-12 in.	Avg MC, % 3 Visits 6-12 in.	Row Spacing ft	Plot Slope %	Distance Upslope from Row 1: Distance to Crest ft	Distance Upslope from Row 1: Relief Diff ft	Watershed Area acres	Valley Floor Width ft	Creek Bed Depth ft
					Bottomlands				
F3	121	31.2	50	1	1400	60	503	500	8
F4	180	30.3	33	2	400	40	732	425	10
C1	205	27.0	55	1, 2*	500	40	22,600	450	10
C3&F6	209	26.2	33	1, 2*	400	40	708	425	10
F1	252	27.4	20	2	150	30	45	180	2
F5	259	27.3	37	1	300	40	416	330	6
C2&F7	296	28.3	23	<1	500	60	108	170	4
F2	319	27.0	17	2	300	50	318	375	9

* Slope changed within the plot; upper slope--left value, lower slope--right value.

Table 6

Sampling by Rows Versus Clusters

Condition	Topographic Position	Visit	Sampling Group	Single Sampling: Std Dev	Single Sampling: Mean	Single Sampling: Coeff of Variation	Triple Sampling: Individual Std Dev	Triple Sampling: Within Group Std Dev	Triple Sampling: Within Group Std Error
Wet	Upland	B	Row	62	201	0.31	56	35	20
		C	Cluster	56	198	0.28	57	25	14
	Bottomland	B	Row	78	205	0.38	76	31	18
		C	Cluster	69	194	0.35	67	21	12
Moist	Upland	A	Row	173	299	0.58	181	90	52
		D	Cluster	179	423	0.42	183	54	31
	Bottomland	A	Row	115	246	0.47	99	68	39
		D	Cluster	108	294	0.37	113	47	27

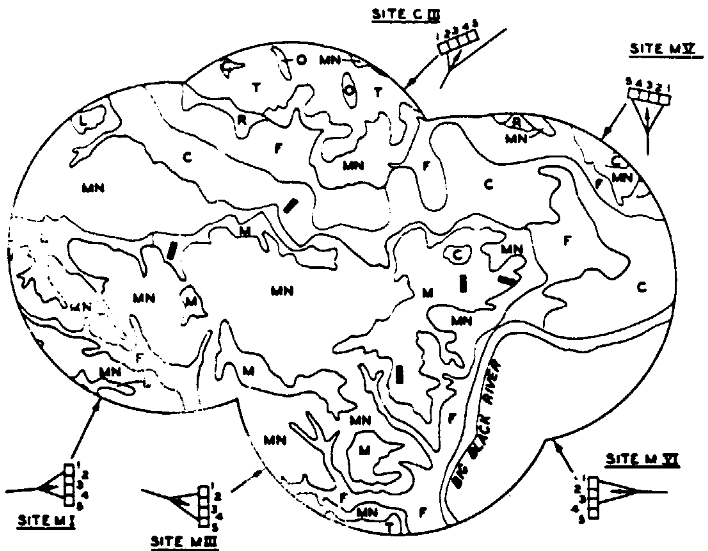
Table 7

Sampling Requirements for Soil Properties by Rows

Soil Property	Probability Level, %	Accuracy Desired ±	Est No. of Samples 0- to 6-in. Layer	6- to 12-in. Layer
Cone index				
Visit A	20	20 units	10	26
Visit B	20	10 units	11	18
Visit C	20	10 units	5	9
Visit D	20	20 units	5	11
Remolding index	20	0.10 unit	--	3
	20	0.05 unit	--	10
Moisture content				
Visit A	20	1%	9	--
Visit B	20	1%	5	5
Sand	5	3%	2	2
Clay	5	3%	6	4
Liquid limit	5	3%	4	5
Plasticity index	5	3%	4	5
Specific gravity	5	0.05 unit	1	1
Dry density	5	0.04 g/cc	3	2
Moisture content (0.06-atm tension)	5	1%	6	4

Key for Identification of Symbols Used in Plate 1

V	Vicksburg silt loam
C	Collins silt and silt loam
VC	Vicksburg and Collins silt loam
F	Falaya silt and silt loam
W	Waverly silt
WF	Waverly and Falaya silt
S	Swamp
T	Lintonia silt
R	Richland silt
O	Olivier silt
K	Calhoun silt
HY	Hymon silt loam
M	Memphis silt
L	Loring silt
LM	Loring and Memphis silt
MN	Memphis and Natchez silt
HN	Henry silt



SITE CIII. PLOT CI COLLINS SERIES
AT ALL ROWS

SITE MV. PLOT M4 MEMPHIS SERIES
AT ROWS 1 AND 5
PLOT AF2 ALLUVIAL FILL
AT ROWS 2, 3, AND 4

SITE MI. PLOT AF1 ALLUVIAL FILL
AT ALL ROWS

SITE MIII. PLOT M2 MEMPHIS SERIES
AT ALL ROWS

SITE MVI. PLOT HN HENRY SERIES
AT ROWS 1 AND 2
PLOT M3 MEMPHIS SERIES
AT ROWS 4 AND 5

VIEW, ORIENTATION, AND SOILS OF TEST SITES

SHEET 1 OF 5

SITE F VIII. PLOT F4 FALAYA SERIES
AT ROWS 1,2,3,AND 4

SITE L V. PLOT L3 LORING SERIES
AT ALL ROWS

SITE L I. PLOT L2 LORING SERIES
AT ALL ROWS

SITE L III PLOT L5 LORING SERIES
AT ALL ROWS

SITE F II. PLOT C3 COLLINS SERIES
AT ROWS I AND 3
PLOT F6 FALAYA SERIES
AT ROWS 2, 4,AND 5

SITE C V. PLOT F5 FALAYA SERIES
AT ROWS 1, 2, 3,AND 4

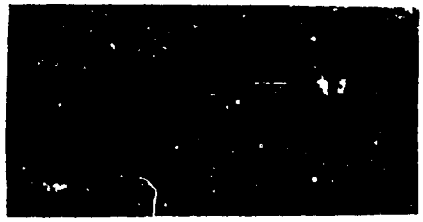
SITE L IV. PLOT L4 LORING SERIES
AT ALL ROWS

VIEW, ORIENTATION, AND SOILS OF TEST SITES

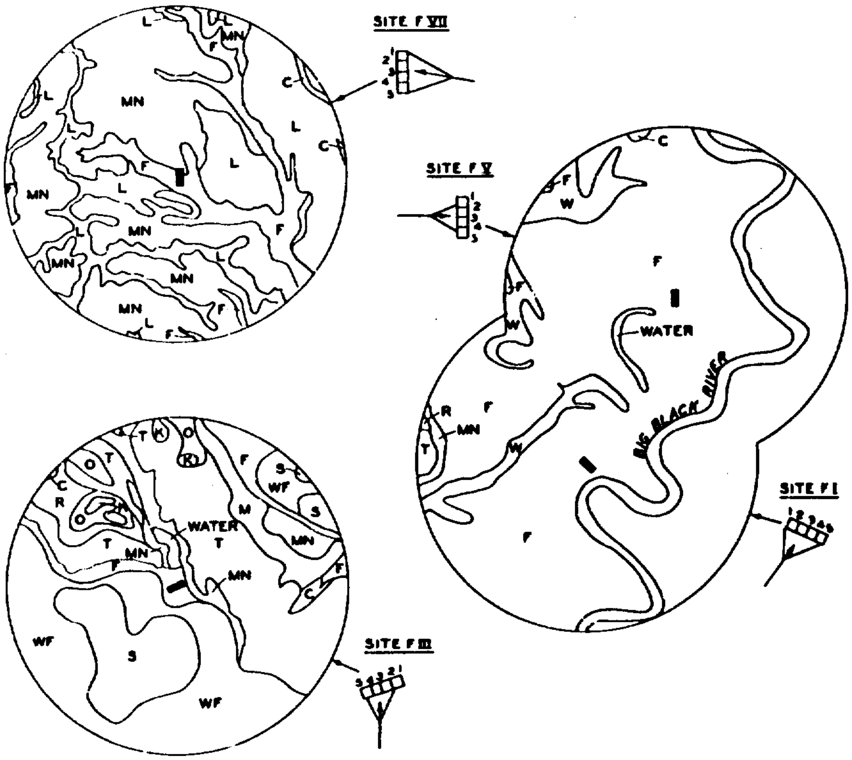
SHEET 2 OF 5

PLATE 1 (2)

SITE F VII. PLOT FI FALAYA SERIES AT ALL ROWS



SITE F V. FALAYA MAP UNIT

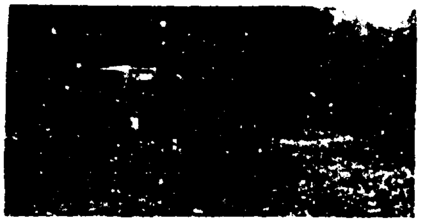


SITE F III. FALAYA MAP UNIT

SITE FI. FALAYA MAP UNIT

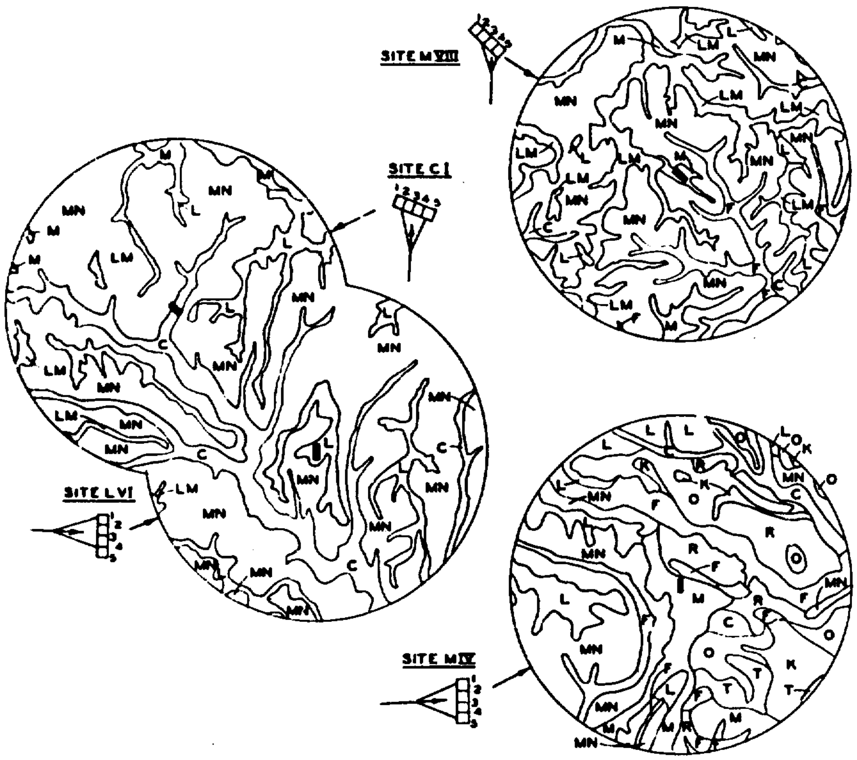
VIEW, ORIENTATION, AND SOILS OF TEST SITES

SHEET 3 OF 5



SITE CI. PLOT F7 FALAYA SERIES
AT ROWS 1 AND 5
PLOT C2 COLLINS SERIES
AT ROWS 2, 3, AND 4

SITE MVIII. MEMPHIS MAP UNIT

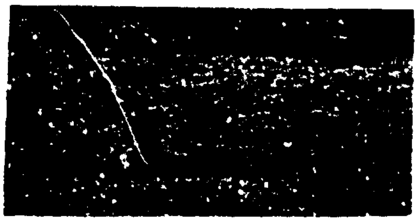


SITE LVI. PLOT LI LORING SERIES
AT ALL ROWS

SITE MIV. PLOT MI MEMPHIS SERIES
AT ALL ROWS

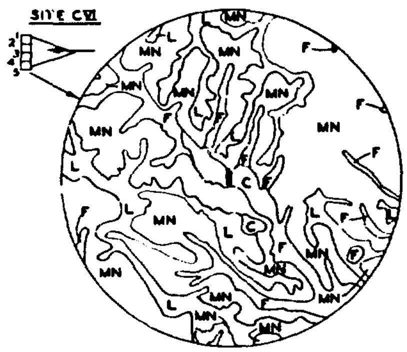
VIEW, ORIENTATION, AND SOILS OF TEST SITES

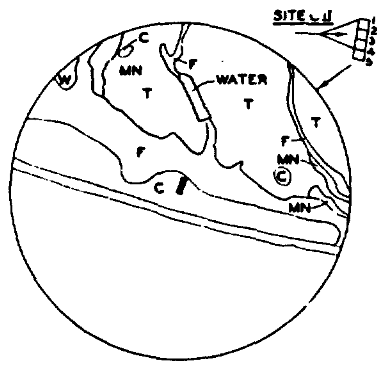
SHEET 4 OF 5

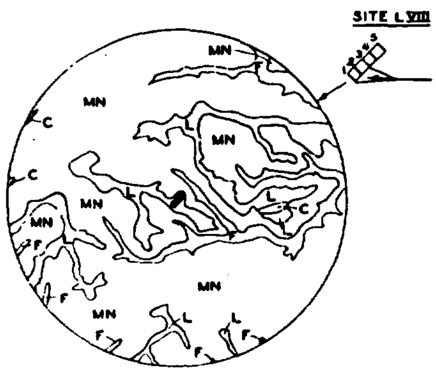


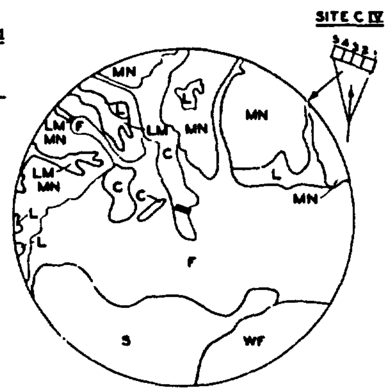
SITE CVI. PLOT F2 FALAYA SERIES AT ALL ROWS

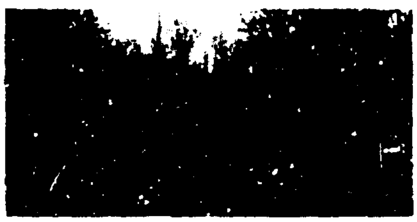
SITE CII. PLOT HY1 HYMON SERIES AT ALL ROWS











SITE LVIII. LORING MAP UNIT

SITE CIV. PLOT F3 FALAYA SERIES AT ALL ROWS

VIEW, ORIENTATION, AND SOILS OF TEST SITES

SHEET 5 OF 5

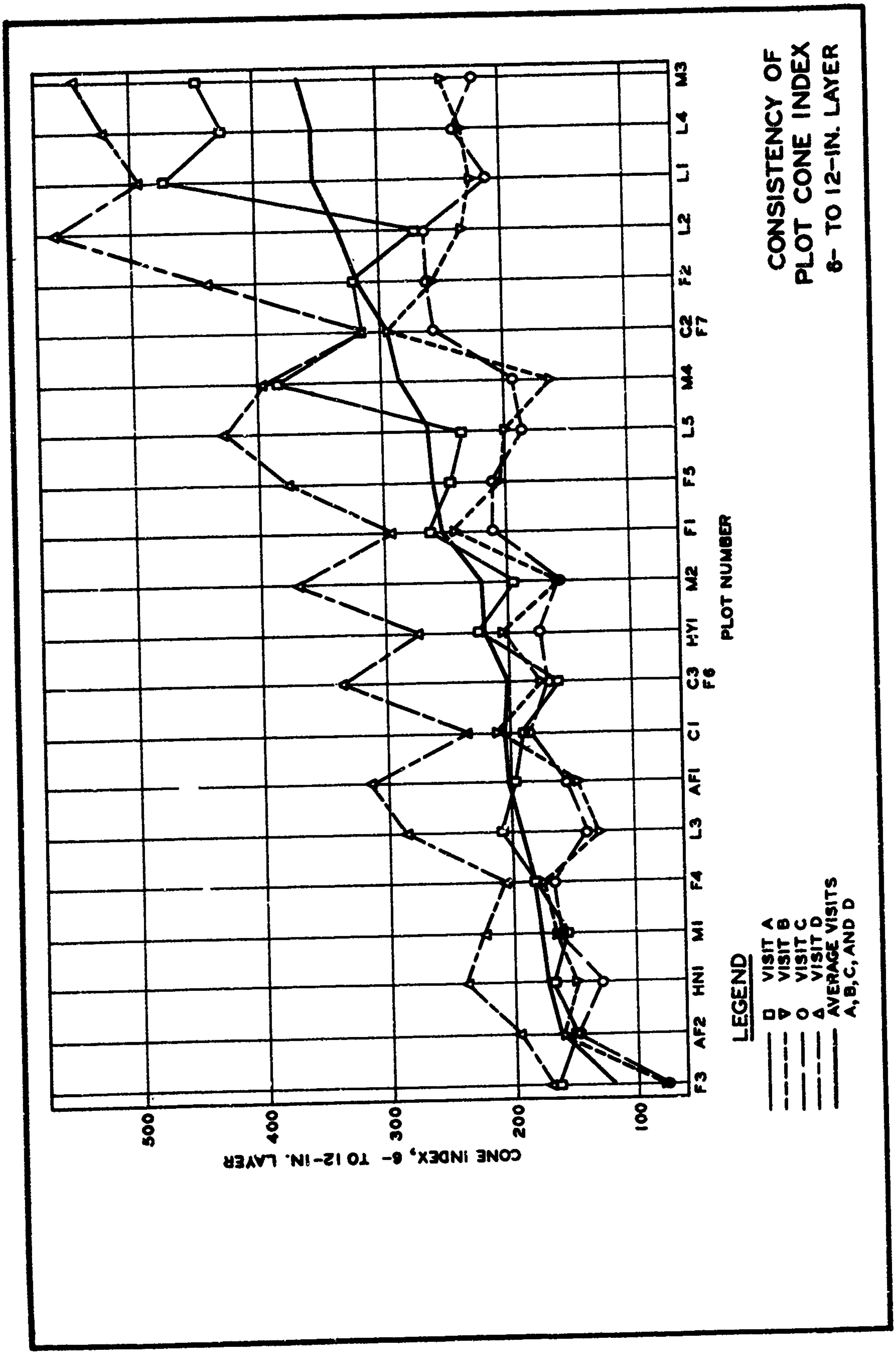
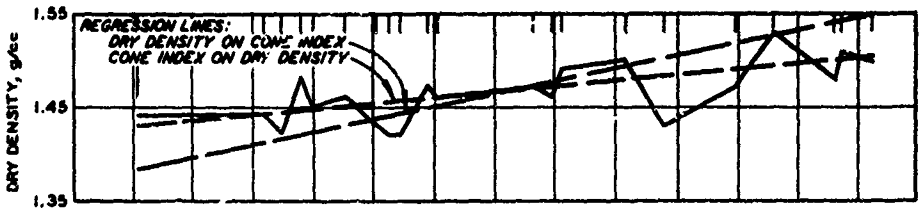
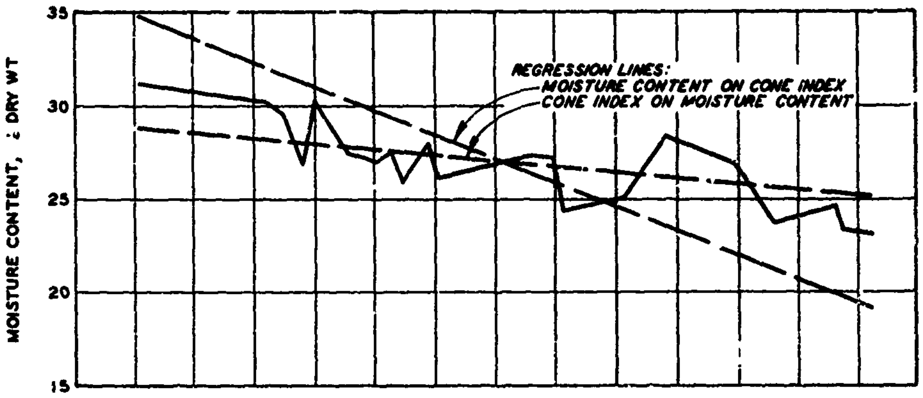

CONSISTENCY OF
PLOT CONE INDEX
6- TO 12-IN. LAYER
CONE INDEX, 6- TO 12-IN. LAYER
500
400
300
200
100
PLOT NUMBER
F3
AF2
HN1
M1
F4
L3
AF1
C1
C3
F6
HY1
M2
F1
F5
L5
M4
C2
F7
F2
L2
L1
L4
M3
LEGEND
VISIT A
VISIT B
VISIT C
VISIT D
AVERAGE VISITS
A, B, C, AND D

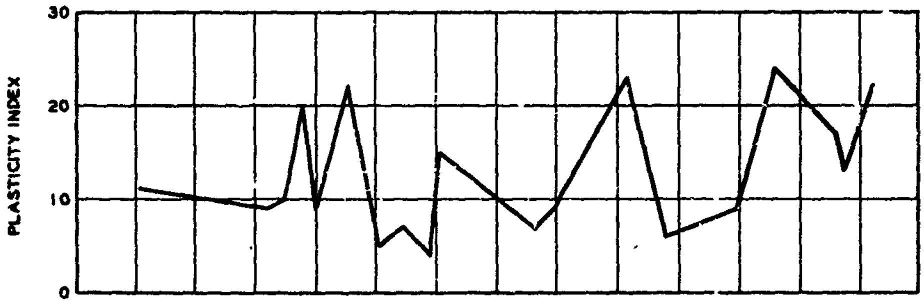
PLATE 2



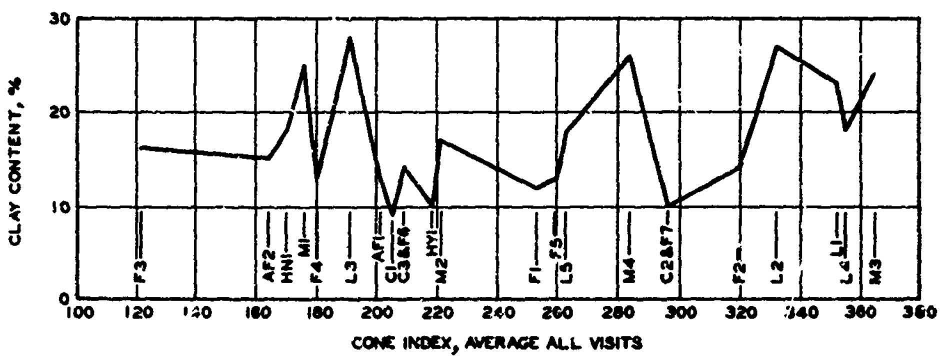
r=0.68, HIGHLY SIGNIFICANT, <1% LEVEL



r=0.49, SIGNIFICANT, 5% LEVEL



r=0.33, SIGNIFICANT, 20% LEVEL

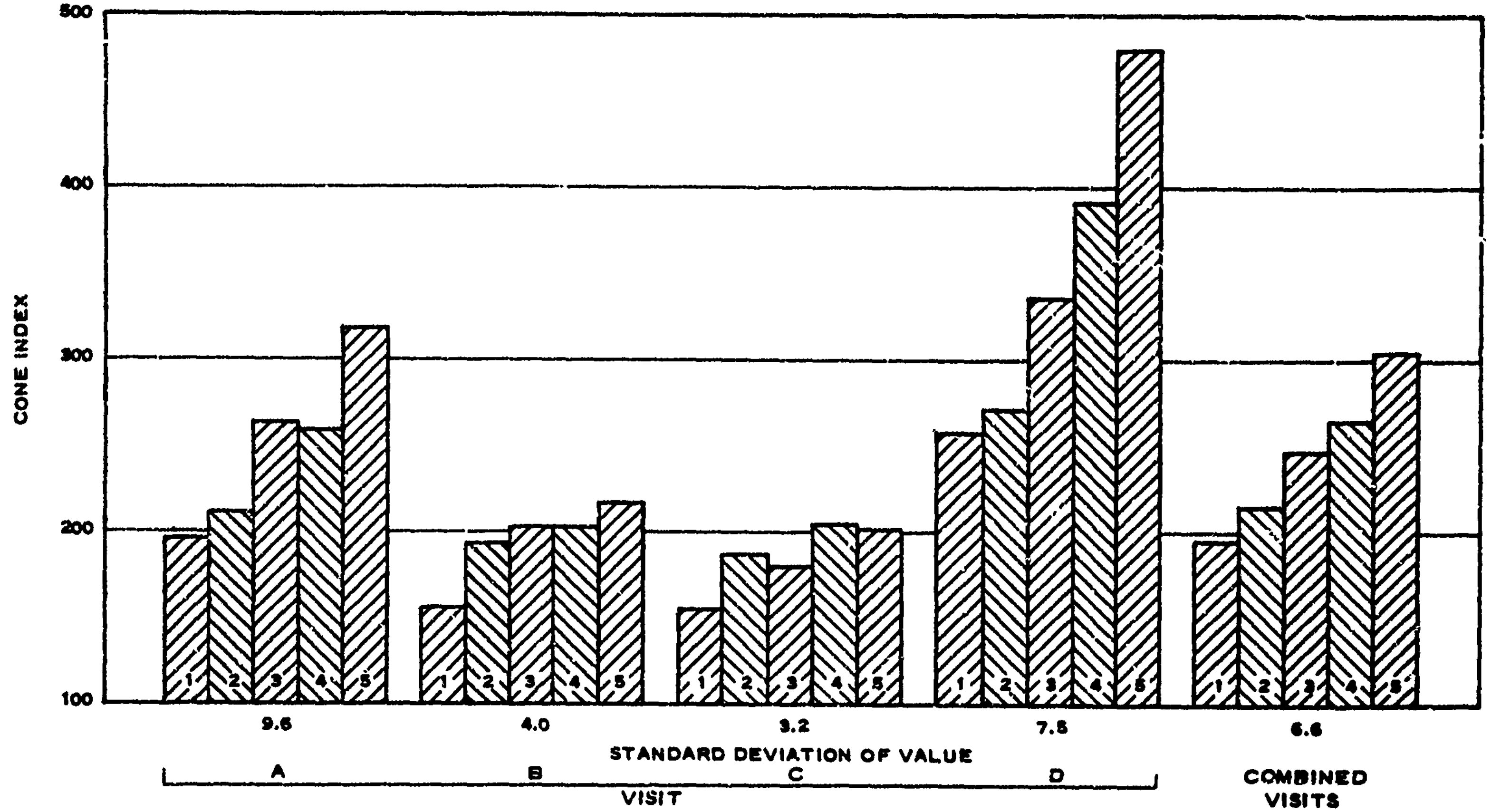


r=0.27, NOT SIGNIFICANT, > 20% LEVEL

NOTE: r DESIGNATES SAMPLE CORRELATION COEFFICIENT.

COMPARISON OF PHYSICAL PROPERTIES AND CONE INDEX
6- TO 12-IN. LAYER

PLATE 3



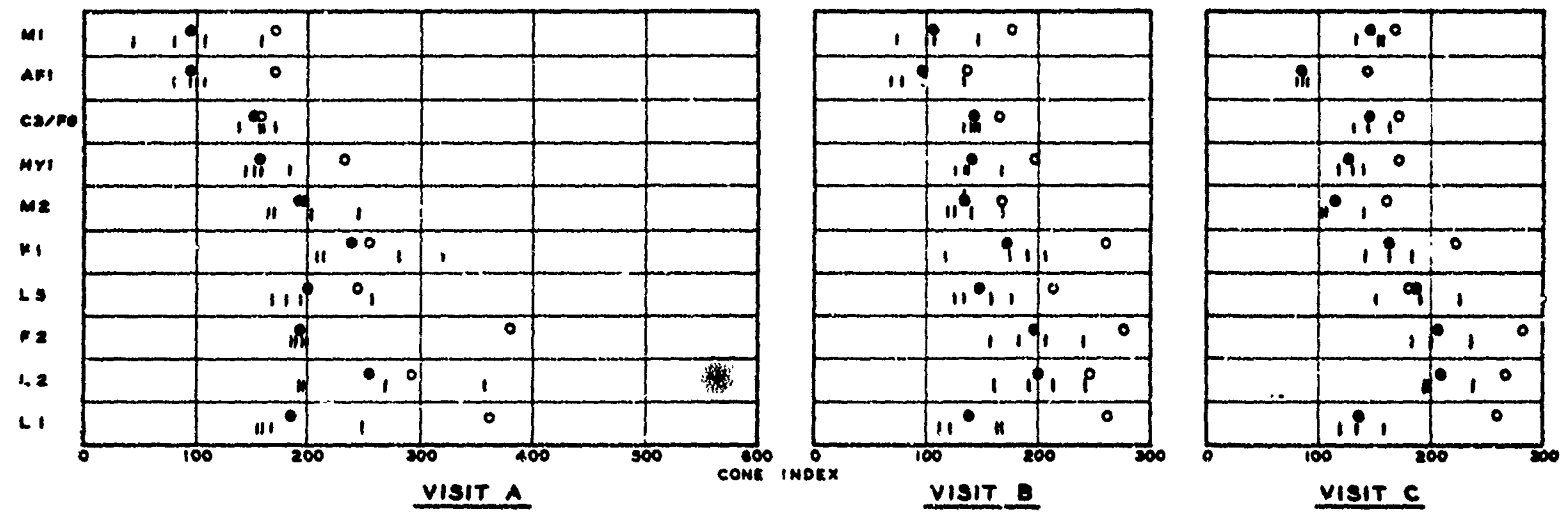
LEGEND

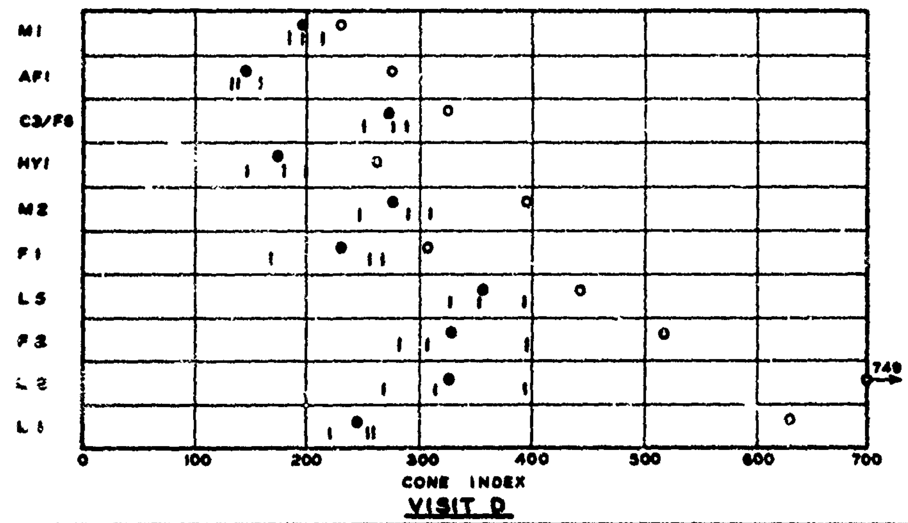
1. LOW-STRENGTH ROW
2. INTERMEDIATE LOW-STRENGTH ROW
3. INTERMEDIATE ROW
4. INTERMEDIATE HIGH-STRENGTH ROW
5. HIGH-STRENGTH ROW

NOTE: RANKING BASED ON COMBINED VISITS FOR EACH PLOT, THEN EACH RANK AVERAGED FOR ALL PLOTS.

CONSISTENCY BY VISITS OF LOW- AND HIGH-STRENGTH ROWS

PLATE 4





LEGEND

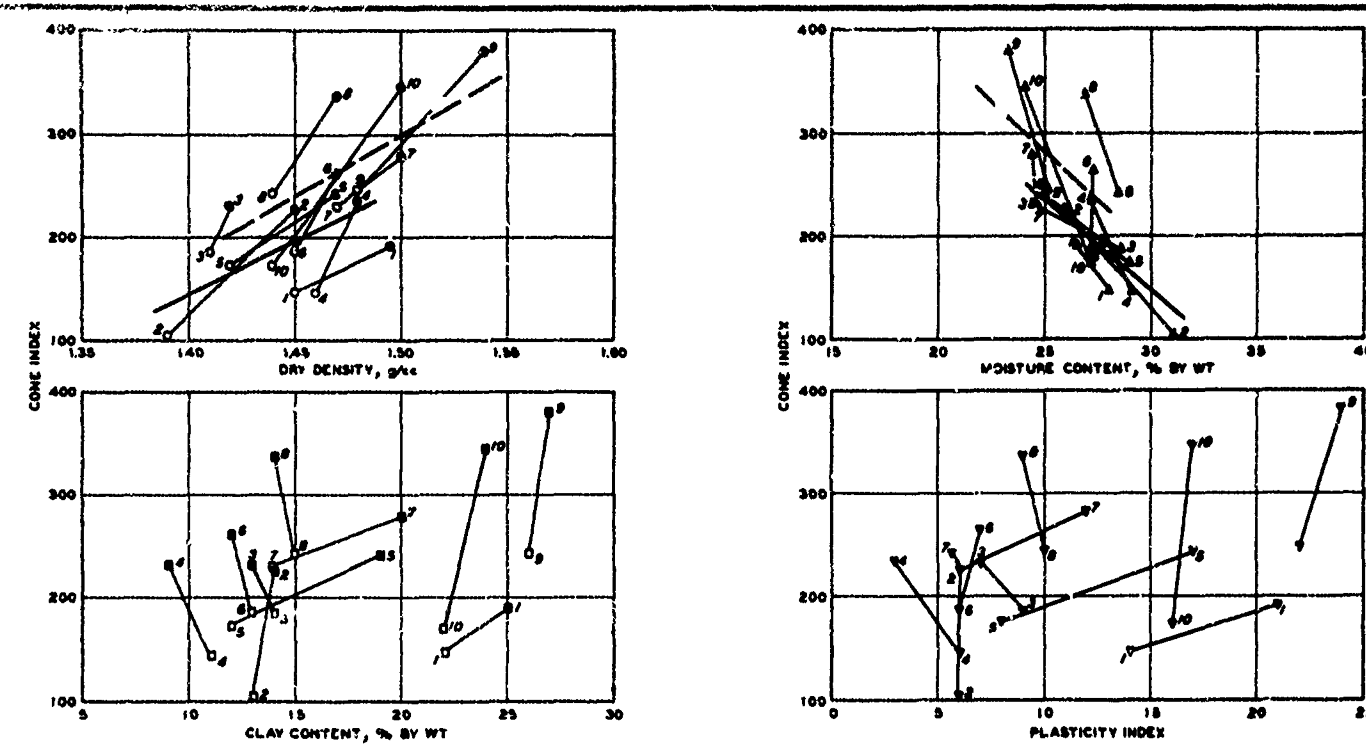
- o PLOT AVERAGE (EXCLUDING EXTREME ROWS)
- ● LOW-STRENGTH ROW AVERAGE
- I INDIVIDUAL MEASUREMENT IN LOW-STRENGTH ROW

NOTE: STANDARD DEVIATION OF INDIVIDUAL MEASUREMENTS WITHIN ROW ≥ 27 CI UNITS.

AVERAGE CONE INDEXES OF PLOTS (EXCLUDING EXTREME ROWS) AND LOW-STRENGTH ROWS

PLATE 5

PLATE 8



LEGEND

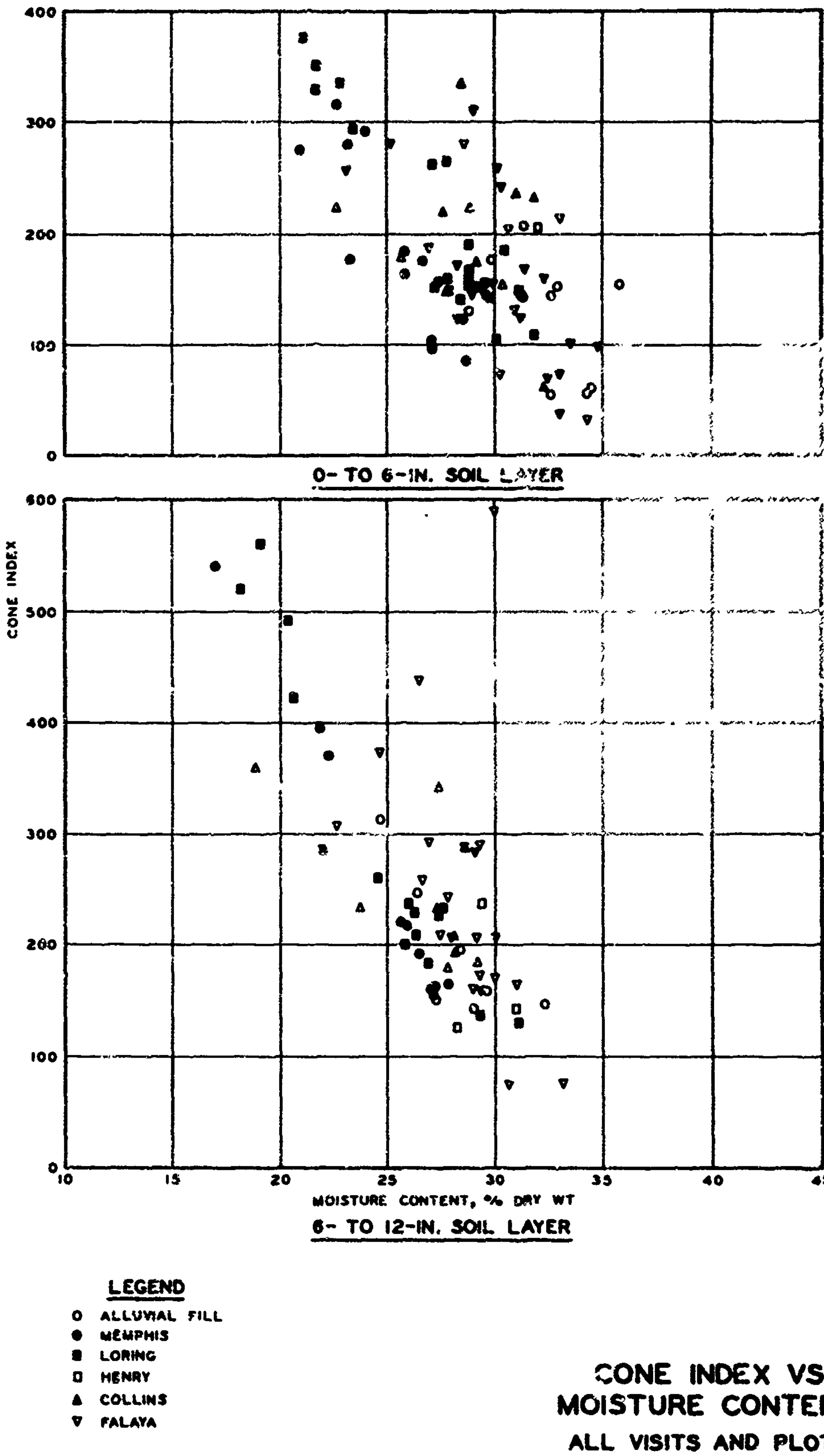
	r	LEVEL OF SIGNIFICANCE
○	0.80	10%
◐	0.81	10%
△	0.75	5%
▲	0.48	20%
□	0.29	NS < 20%
■	0.39	NS < 20%
▽	0.36	NS < 20%
▼	0.37	NS < 20%

○ LOW-STRENGTH ROW AVERAGE
——— LINE OF REGRESSION FOR LOW-STRENGTH-ROW DATA
● PLOT AVERAGE (EXCLUDING EXTREME ROWS)
— — — LINE OF REGRESSION FOR PLOT-AVERAGE DATA
r CORRELATION COEFFICIENT

IDENTIFICATION

	PLOT	LOW-STRENGTH ROW
1	M1	5
2	AF1	2
3	C3/78	4
4	HY1	1
5	M2	2
6	F1	1
7	L5	5
8	F2	2
9	L2	5
10	L1	3

COMPARISON OF AVERAGE CONE INDEXES FOR LOW-STRENGTH ROW AND PLOT (EXCLUDING EXTREME ROWS) WITH OTHER SOIL PROPERTIES



CONE INDEX VS MOISTURE CONTENT

ALL VISITS AND PLOTS

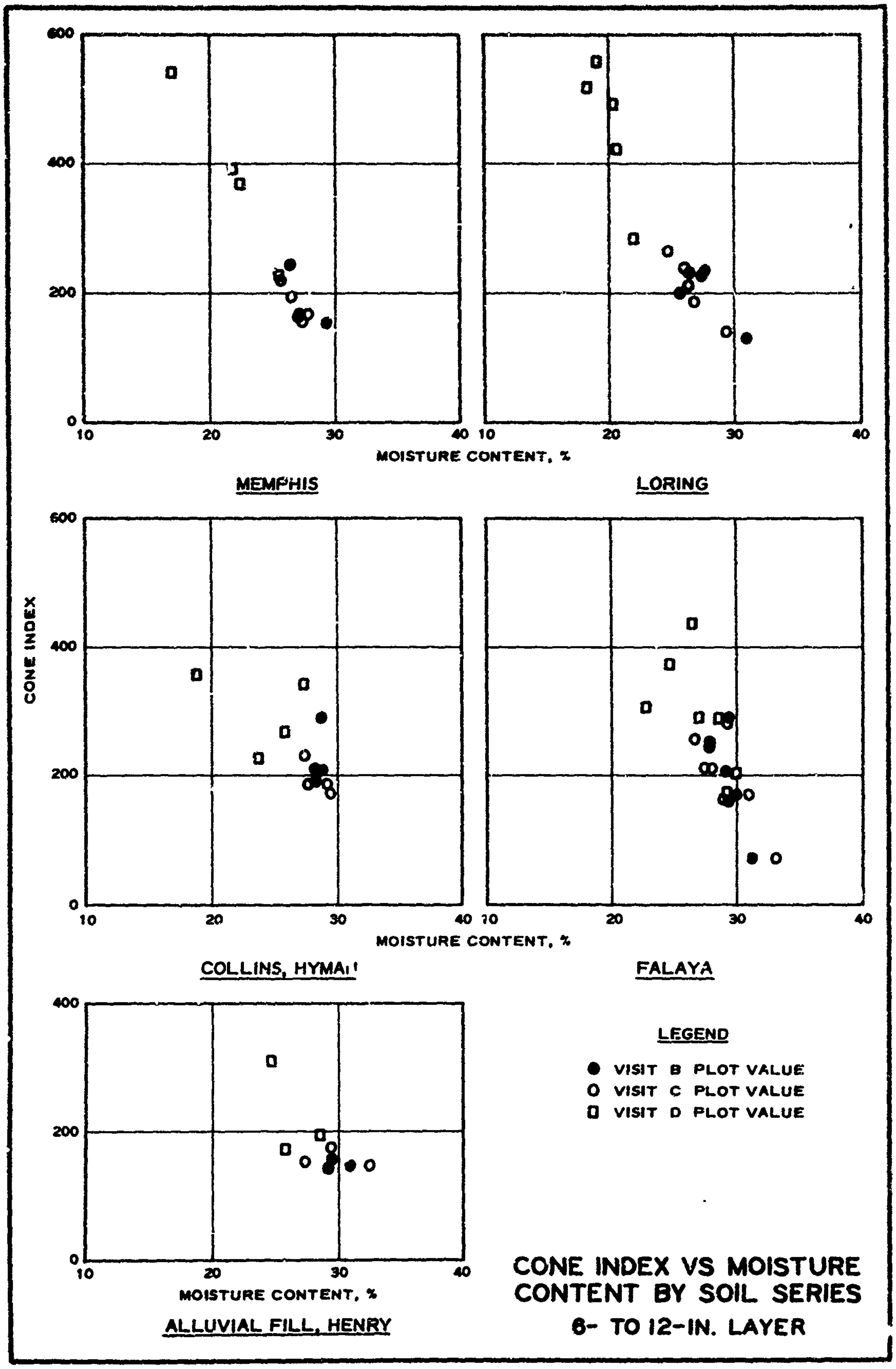
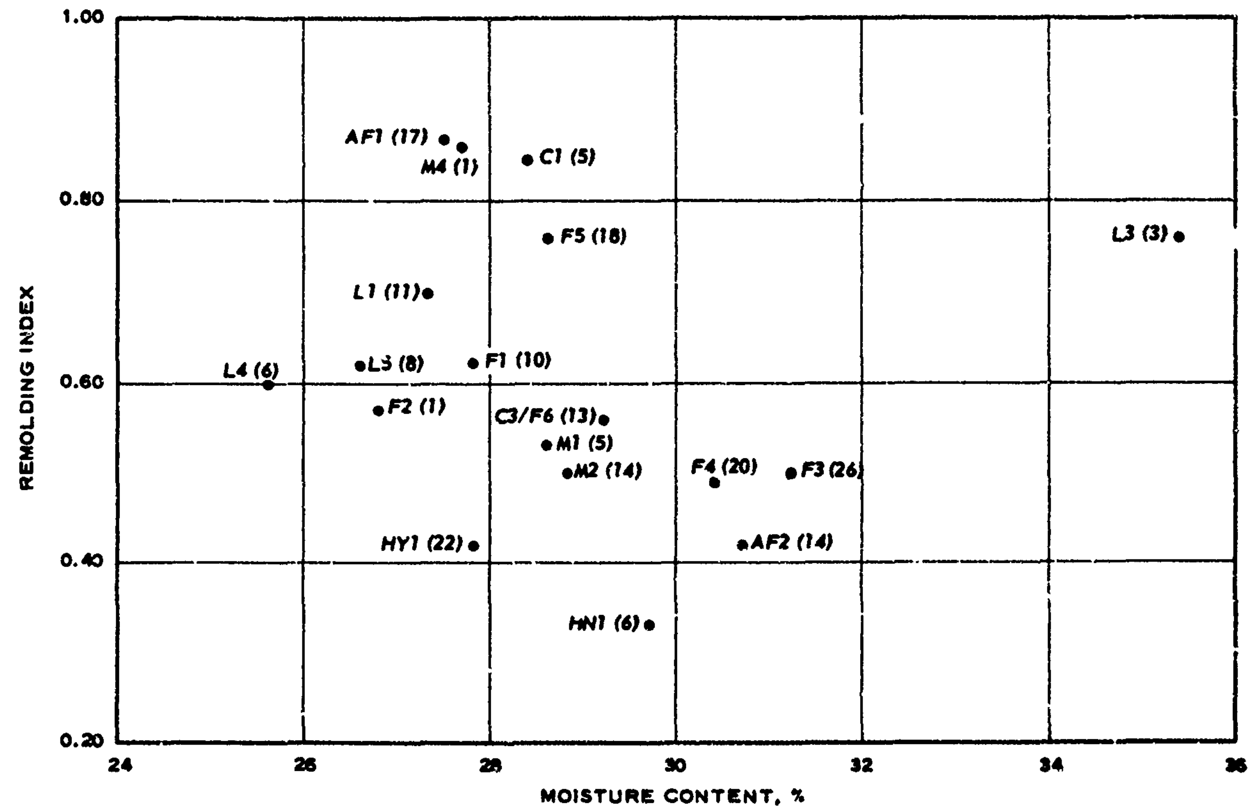

600
400
200
0
10
20
30
40
MOISTURE CONTENT, %
MEMPHIS
LORING
CONE INDEX
COLLINS, HYMAN
FALAYA
ALLUVIAL FILL, HENRY
LEGEND
● VISIT B PLOT VALUE
O VISIT C PLOT VALUE
□ VISIT D PLOT VALUE
CONE INDEX VS MOISTURE
CONTENT BY SOIL SERIES
6- TO 12-IN. LAYER

PLATE 8



NOTE: NUMBER OF VALUES PER PLOT IS SHOWN IN PARENTHESES AFTER PLOT DESIGNATION.

REMOLDING INDEX VS MOISTURE CONTENT BY PLOT AVERAGE

6- TO 12-IN. LAYER

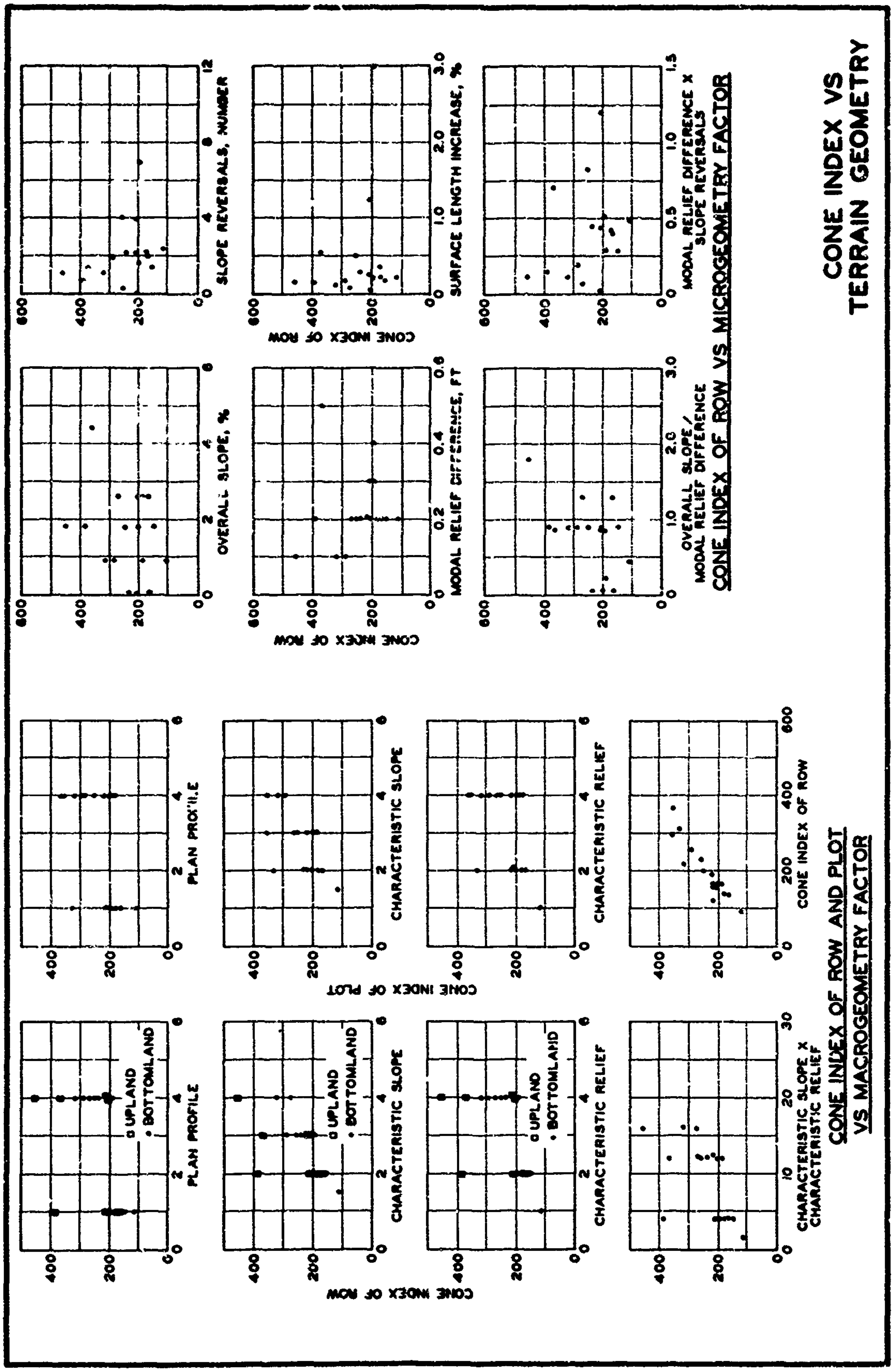

CONE INDEX VS
TERRAIN GEOMETRY
CONE INDEX OF ROW VS MICROGEOMETRY FACTOR
CONE INDEX OF ROW AND PLOT
VS MACROGEOMETRY FACTOR
SLOPE REVERSALS, NUMBER
SURFACE LENGTH INCREASE, %
MODAL RELIEF DIFFERENCE X SLOPE REVERSALS
OVERALL SLOPE, %
MODAL RELIEF DIFFERENCE, FT
OVERALL SLOPE / MODAL RELIEF DIFFERENCE
CONE INDEX OF ROW
CONE INDEX OF PLOT
PLAN PROFILE
CHARACTERISTIC SLOPE
CHARACTERISTIC RELIEF
CHARACTERISTIC SLOPE X CHARACTERISTIC RELIEF
UPLAND
BOTTOMLAND

PLATE 10

APPENDIX A: BASIC DATA

This appendix contains basic data for each of the test sites. Table A1 contains soil strength measurements including cone index and moisture content obtained on four visits to each site. Table A2 contains data on soil properties including United States Department of Agriculture and Unified Soil Classification System soil classes, grain-size analysis, dry density, specific gravity, and moisture contents at 0-, 0.015-, 0.03-, and 0.06-atm tensions.

Table A1

Strength and Moisture Content of Soils at Test Sites*

Identification				Visit A			Visit B					Visit C					Visit D				
			Posi-	CI		MC	CI		RI	MC		CI		RI	MC		CI		RI	MC	
Site	Plot	Row	tion	0-6	6-12	0-6	0-6	6-12	6-12	0-6	6-12	0-6	6-12	6-12	0-6	6-12	0-6	6-12	0-6	0-6	6-12
										Alluvial Fill											
M I	AF1	1	A	42	82	33.9	49	97	0.67	29.1	28.3										
			A1									27	110		28.1	26.4	150	275		21.1	20.1
			A2									53	173				162	280			
			A3									47	140				192	262			
			B	12	158	29.2	32	217		29.4	27.8										
			C	18	32	33.4	26	63	0.44	30.8	30.6										
			D	52	158	23.5	62	120		28.8	27.4										
		2	A	42	80	36.3	13	79	0.18	33.6	32.6										
			A1									34	87				65	138		30.8	30.8
			A2									37	83				65	158			
			A3									48	86				100	132			
			B	55	100	34.7	60	133	0.28	34.1	31.6										
			C	68	108	35.9	64	95	0.32	33.2	31.3										
			D	48	95	38.4	35	67	0.24	36.7	30.2										
		3	A	95	350	41.2	34	205	0.49	35.4	26.6										
			A1									123	293		34.2	27.5	158	550		29.4	24.9
			A2									86	227				205	600			
			A3									82	217				188	592			
			B	50	358	39.9	26	216		36.2	28.1										
			C	65	238	35.0	122	290		33.7	22.1										
			D	232	525	39.1	93	190	0.40	31.5	29.8										
		4	A	75	155	35.1	55	120	0.48	35.5	30.2										
			A1									36	97				108	282		31.2	22.7
			A2									30	105				95	258			
			A3									50	107				100	258			
			B	52	212	30.6	67	112	0.33	37.7	28.6										
			C	50	192	40.7	102	238		35.6	29.5										
			D	32	220	33.4	86	196	0.45	36.9	27.6										
		5	A	82	218	32.0	86	182	0.19	38.3	31.2										
			A1									67	195	0.51	35.8	27.9	120	258	1.68	31.5	25.0
			A2									64	167				115	288			
			A3									77	193				140	330			
			B	45	208	32.5	59	136	0.47	38.0	29.1										
			C	62	255	31.5	57	107	0.67	36.8	27.9										
			D	38	180	34.0	36	73	0.64	34.5	31.6										
M V	AF2	2	A	148	155	31.3	212	203	0.49	31.8	27.1										
			A1									170	160				168	145		32.9	27.2
			A2									173	145				188	158			
			A3									160	150				195	225			
			B	192	208	31.1	193	192	0.50	32.5	28.1										
			C	162	182	31.4	149	143	0.52	31.0	27.6										
			D	132	120	31.5	125	134	0.66	33.4	28.0										
		3	A	105	162	37.3	120	157	0.20	34.1	32.2										
			A1									133	172	0.23	35.7	32.3	270	218	0.63	30.8	30.3
			A2									135	158				218	200			
			A3									122	153				188	162			
			B	188	212	34.3	129	153	0.25	37.1	31.7										
			C	170	150	36.1	130	192	0.28	32.3	32.9										
			D	162	182	31.8	172	163	0.28	34.4	32.1										
		4	A	100	45	30.9	147	148	0.34	30.9	28.2										
			A1									198	125				232	238		30.3	27.7
			A2									168	128				242	218			
			A3									167	142				182	200			
			B	130	145	30.8	158	151	0.38	30.3	29.6										
			C	158	142	34.0	177	142	0.38	32.2	28.4										
			D	120	102	31.3	143	137	0.40	34.4	29.1										
										Memphis Soil Series											
M IV	M1	1	A	105	180	27.6	122	217		27.2	27.5										
			A1									115	175		26.0	27.3	152	212		21.8	26.3
			A2									87	175				150	230			
			A3									153	190				100	200			
			B	130	158	27.2	70	159		27.3	27.4										
			C	130	220	28.3	112	196		26.9	25.8										
			D	132	242	27.7	105	202		27.3	27.3										
		2	A	42	118	29.0	93	170		27.4	26.8										
			A1									97	142				195	238		23.5	24.4
			A2									103	172				125	188			
			A3									125	183				138	192			
			B	88	145	29.6	87	133		28.2	27.1										
			C	62	158	29.1	88	182		26.5	26.2										
			D	145	205	26.0	109	195		26.8	26.9										

(Continued)

Note: "0-6" and "6-12" indicate 0- to 6-in. and 6- to 12-in. soil layers, respectively. CI indicates cone index. MC indicates moisture content, percent dry weight. RI indicates remolding index.
* Data are listed by plots according to field-identified soil series.

(1 of 9 sheets)

Table A1 (Continued)

Identification				Visit A			Visit B					Visit C					Visit D				
				CI		MC	CI		RI	MC		CI		RI	MC		CI		RI	MC	
Site	Plot	Row	Posi-tion	0-6	6-12	0-6	0-6	6-12	6-12	0-6	6-12	0-6	6-12	6-12	0-6	6-12	0-6	6-12	0-6	0-6	6-12
											Memphis Soil Series (Continued)										
M IV	M1	3	A	62	132	27.3	92	160		28.5	26.9										
			A1									100	148		27.4	27.3	195	262		22.4	25.1
			A2									148	210				208	245			
			A3									95	202				175	230			
			B	92	205	25.2	97	187		27.5	26.2										
			C	72	175	29.8	73	220		26.7	26.7										
			D	92	230	30.1	96	168		25.7	25.2										
		4	A	62	150	30.7	94	184		26.4	26.8										
			A1									100	145				205	255		23.2	26.1
			A2									103	165				188	268			
			A3									78	105				175	232			
			B	48	75	28.8	72	100		27.4	27.0										
			C	110	225	30.6	122	202		26.6	27.8										
			D	55	108	28.3	118	159		25.3	26.7										
		5	A	62	80	28.1	140	144	0.53	28.0	28.8										
			A1									117	157	0.52	28.2	26.7	250	212		25.5	26.6
			A2									85	152				195	182			
			A3									123	132				230	195			
			B	25	42	28.3	89	71	0.68	28.6	28.5										
			C	70	108	31.8	92	102	0.45	28.3	29.1										
			D	142	158	30.1	101	100	0.46	27.9	28.1										
M III	M2	1	A	222	220	31.2	167	173	0.44	31.7	31.2										
			A1									163	175	0.31	32.0	28.3	312	275		26.3	24.6
			A2									117	145				320	345			
			A3									147	140				380	292			
			B	210	173	29.5	165	158	0.69	31.8	28.6										
			C	280	213	29.0	160	170	0.52	31.9	27.9										
			D	200	240	31.4	145	148	0.47	31.8	27.4										
		2	A	157	163	32.1	147	138	0.37	31.4	39.1										
			A1									155	140				118	245		27.3	25.2
			A2									157	100				308	308			
			A3									127	103				332	288			
			B	140	247	32.9	145	160	0.57	33.3	30.4										
			C	153	167	30.2	120	118	0.45	34.3	32.4										
			D	188	202	33.7	132	122	0.57	33.1	30.1										
		3	A	167	167	29.3	200	198		29.9	28.3										
			A1									217	193	0.55	27.3	26.9	300	375		22.6	22.7
			A2									147	125				282	392			
			A3									222	188				312	292			
			B	247	240	30.4	113	143		31.5	27.4										
			C	157	193	27.4	180	142		31.0	28.1										
			D	193	200	29.1	137	185		32.1	26.5										
		4	A	193	217	29.8	142	142		28.4	27.7										
			A1									158	190				312	538		17.4	16.3
			A2									155	170				420	525			
			A3									160	175				375	525			
			B	137	143	28.7	183	212		31.0	27.7										
			C	143	167	28.7	143	152		31.2	28.8										
			D	150	183	30.0	120	167		31.3	28.5										
		5	A	182	222	28.0	127	183	0.54	30.4	29.0										
			A1									120	173		28.1	26.5	295	382		19.2	23.2
			A2									138	190				350	405			
			A3									128	160				356	388			
			B	153	212	29.0	133	198	0.60	30.3	26.9										
			C	125	183	30.2	150	142	0.72	31.0	28.1										
			D	163	163	28.5	128	138	0.66	31.7	28.0										
M IV	M3	4	A	138	145	26.2	235	257		24.6	26.3										
			A1									132	152				218	332		23.3	23.6
			A2									168	177				230	392			
			A3									160	205				225	355			
			B	125	200	27.6	184	187		26.5	27.5										
			C	182	238	27.4	146	270		25.9	25.9										
			D	220	270	27.2	206	226		27.2	28.1										
		5	A	520	720	22.0	173	272		24.9	24.8										
			A1									172	260		25.6	25.8	275	688		18.8	10.4
			A2									185	258				345	732			
			A3									177	272				368	750			
			B	388	650	20.4	128	246		24.9	26.2										
			C	250	632	20.3	195	247		26.4	26.5										
			D	520	732	20.8	195	284		26.4	25.8										
M V	M4	1	A	210	400	27.3	138	162		27.8	26.8										
			A1									163	223		26.5	25.1	392	605		21.2	21.2
			A2									180	203				212	270			
			A3									170	210				345	512			
			B	158	375	24.6	143	203		27.0	26.0										
			C	150	305	26.4	125	146		28.4	26.8										
			D	170	412	28.8	127	158		27.2	26.4										

(Continued)

Table A1 (Continued)

Identification				Visit A			Visit B					Visit C					Visit D				
				CI		MC	CI		RI	MC		CI		RI	MC		CI		RI	MC	
Site	Plot	Row	Posi-tion	0-6	6-12	0-6	0-6	6-12	6-12	0-6	6-12	0-6	6-12	6-12	0-6	6-12	0-6	6-12	0-6	0-6	6-12
Memphis Soil Series (Continued)																					
M V	M4	5	A	128	455	25.9	105	147	0.86	30.0	27.7										
			A1									130	170		28.2	27.9	300	368		25.3	22.4
			A2									143	168				212	300			
			A3									158	177				225	325			
			B	322	650	23.6	145	178		27.7	28.0										
			C	162	242	27.0	120	162		31.3	27.7										
			D	108	225	29.6	99	135		28.9	27.5										
Loring Soil Series																					
L VI	L1	1	A	358	650	20.4	155	298		27.2	26.0										
			A1									162	250		29.5	25.7	512	750		18.3	13.5
			A2									182	270				482	750			
			A3									158	282				445	750			
			B	350	750	26.7	137	243		26.9	26.5										
			C	232	468	31.1	103	203		32.0	28.1										
			D	258	368	29.0	163	203		31.0	28.0										
		2	A	142	250	28.7	168	235	0.26	27.4	29.0										
			A1									150	163				268	375	0.67	24.6	23.5
			A2									128	130				230	355			
			A3									85	115				255	278			
			B	182	300	26.6	133	168	0.23	28.7	24.3										
			C	125	208	30.6	173	232	0.50	31.7	29.6										
			D	142	258	32.1	173	223	0.34	33.3	29.4										
		3	A	100	250	32.6	157	162	0.51	32.3	29.4										
			A1									137	133	1.02	29.6	27.2	218	255	0.62	27.6	25.8
			A2									162	118				175	255			
			A3									172	157				168	220			
			B	83	158	32.4	92	120	0.57	31.5	29.1										
			C	83	168	30.5	103	163	0.64	35.8	29.2										
			D	100	158	32.5	98	110		30.6	27.6										
		4	A	375	600	27.9	158	232		25.5	28.0										
			A1									140	218				280	368		21.4	23.3
			A2									138	220				282	338			
			A3									170	232				345	468			
			B	532	718	23.7	222	250		24.1	24.9										
			C	425	692	25.3	215	257		25.4	26.6										
			D	268	600	29.1	165	275		27.8	26.4										
		5	A	225	618	27.2	170	293		26.1	26.2										
			A1									185	282		27.4	26.1	592	750		16.7	15.8
			A2									168	300				475	750			
			A3									183	298				532	750			
			B	442	750	19.7	198	297		25.7	27.5										
			C	458	750	22.3	250	300+		25.6	26.4										
			D	442	750	25.9	180	300+	0.37	26.9	25.8										
L I	L2	1	A	180	218	30.2	200	300		32.4	27.4										
			A1									207	300		29.3	23.8	525	750		21.9	18.7
			A2									220	300				412	750			
			A3									217	300				420	718			
			B	242	255	28.5	207	193		29.1	25.1										
			C	180	220	26.5	237	300		30.8	25.5										
			D	175	308	27.6	195	185		28.6	27.3										
		2	A	230	418	33.0	240	300		30.4	24.7										
			A1									207	300				232	275		28.6	23.8
			A2									225	300				232	225			
			A3									230	300				200	268			
			B	142	108	30.3	130	132		34.2	28.0										
			C	100	142	30.1	200	250		31.7	26.1										
			D	112	200	33.6	150	217		32.6	27.3										
		3	A	130	192	30.8	170	293		30.1	27.2										
			A1									153	260		29.3	24.3	480	750		18.6	15.5
			A2									188	287				455	750			
			A3									207	300				438	750			
			B	130	332	26.8	188	230		29.6	28.0										
			C	112	250	28.2	143	218		29.7	30.4										
			D	112	330	28.1	193	240		30.3	28.8										
		4	A	318	625	23.6	175	240		30.4	28.5										
			A1									167	237				432	732		17.7	15.5
			A2									173	200				458	750			
			A3									182	225				432	732			
			B	162	445	26.8	113	170		33.2	29.9										
			C	162	188	28.1	227	300		27.4	28.0										
			D	170	170	29.5	233	300		28.7	28.6										

(Continued)

Table A1 (Continued)

Identification				Visit A			Visit B					Visit C					Visit D				
				CI		MC	CI		RI	MC		CI		RI	MC		CI		RI	MC	
Site	Plot	Row	Position	0-6	6-12	0-6	0-6	6-12	6-12	0-6	6-12	0-6	6-12	6-12	0-6	6-12	0-6	6-12	0-6	0-6	6-12
										Loring Soil Series (Continued)											
L I	L2	5	A	220	358	27.5	180	240		30.3	21.5										
			A1									183	193		27.7	25.8	268	268		19.3	22.0
			A2									142	237				350	312			
			A3									163	197				358	392			
			B	205	270	27.6	175	213		32.2	29.1										
			C	112	195	34.5	158	190		30.2	28.0										
			D	200	192	26.3	175	160		28.6	31.8										
L V	L3	1	A	155	258	29.9	120	143		35.5	32.9										
			A1									125	133		29.4	29.7	242	342		21.3	19.5
			A2									100	120				308	342			
			A3									130	188				280	342			
			B	168	242	28.0	103	125		30.9	31.9										
			C	180	238	29.2	105	187		31.7	30.8										
			D	118	168	28.6	93	145		31.2	29.7										
		2	A	118	150	28.8	62	72	0.80	33.5	33.3										
			A1									70	127				300	280		22.5	23.8
			A2									75	130				305	250			
			A3									70	143				220	255			
			B	132	180	32.0	117	148		32.6	29.1										
			C	150	150	28.2	105	117	0.74	25.1	40.0										
			D	150	130	31.4	132	95	0.75	34.0	32.7										
		3	A	145	155	31.3	95	127		33.1	31.9										
			A1									103	108	0.54	31.1	30.7	350	320		22.0	19.9
			A2									103	127				342	300			
			A3									100	115				338	320			
			B	200	200	28.3	105	142		36.4	31.4										
			C	220	282	28.9	145	188		31.8	30.6										
			D	220	262	29.1	115	135		30.2	30.0										
		4	A	175	245	29.7	72	95		31.2	31.2										
			A1									102	133				350	342		23.6	21.4
			A2									120	145				332	308			
			A3									123	123				325	275			
			B	132	180	29.0	112	123		32.2	32.4										
			C	188	230	29.3	135	113		30.5	26.5										
			D	218	350	22.0	162	167		25.1	29.6										
		5	A	108	150	34.2	78	93		33.8	31.8										
			A1									130	147		30.1	27.9	225	208		27.6	25.3
			A2									140	172				250	208			
			A3									127	170				250	225			
			B	125	205	24.8	136	157		34.4	27.8										
			C	125	200	30.8	93	127		33.6	28.9										
			D	132	188	29.4	137	123		31.4	30.3										
L IV	L4	1	A	182	455	28.4	117	260		29.0	25.6										
			A1									135	263		25.9	24.7	232	468		23.5	17.1
			A2									157	247				255	598			
			A3									170	277				230	380			
			B	162	318	29.6	162	243		28.3	24.9										
			C	158	438	32.2	133	213		28.5	26.5										
			D	338	750	24.5	120	267		27.2	24.2										
		2	A	308	550	31.1	120	167		30.3	27.8										
			A1									147	220				392	732		22.2	16.2
			A2									108	177				385	750			
			A3									100	163				392	750			
			B	345	750	23.1	128	152		30.4	29.9										
			C	458	750	25.6	112	177		30.6	27.4										
			D	350	442	22.1	115	240		30.7	26.9										
		3	A	145	382	23.8	138	280		29.9	27.0										
			A1									93	210		28.9	28.0	258	482		21.9	17.4
			A2									137	237				350	492			
			A3									82	170				345	545			
			B	288	588	24.6	167	243		28.3	27.7										
			C	132	300	32.9	95	210		27.7	25.9										
			D	332	525	27.4	122	225		29.1	26.1										
		4	A	208	308	28.0	217	257	0.72	24.6	23.5										
			A1									193	287				412	445		18.2	16.0
			A2									198	292				400	418			
			A3									180	257				318	405			
			B	145	220	28.8	187	220		24.4	27.0										
			C	155	150	29.6	210	293		24.2	25.7										
			D	175	205	33.0	227	287		23.2	24.6										
		5	A	362	345	23.9	223	235	0.56	29.2	25.4										
			A1									212	300	0.58	27.2	25.2	308	325		22.9	22.5
			A2									177	170				358	400			
			A3									205	300				330	608			
			B	332	255	27.2	210	253	0.60	26.9	26.0										
			C	320	458	25.5	213	210	0.43	26.7	27.4										
			D	382	342	23.3	203	213	0.49	27.8	27.8										

(Continued)

Table A1 (Continued)

Identification				Visit A			Visit B					Visit C					Visit D				
				CI		MC	CI		RI	MC		CI		RI	MC		CI		RI	MC	
Site	Plot	Row	Position	0-6	6-12	0-6	0-6	6-12	6-12	0-6	6-12	0-6	6-12	6-12	0-6	6-12	0-6	6-12	0-6	0-6	6-12
										Loring Soil Series (Continued)											
L III	L5	1	A	125	405	24.9	113	178		27.5	23.5										
			A1									88	167		27.2	27.8	430	550		21.7	19.5
			A2									117	143				442	682			
			A3									77	145				362	558			
			B	138	155	39.7	143	207		28.9	25.7										
			C	132	432	23.0	113	163		28.0	25.2										
			D	92	175	27.2	147	223		29.7	25.1										
		2	A	138	155	28.8	173	227		25.7	27.8										
			A1									150	170				308	392		21.0	21.0
			A2									170	197				292	268			
			A3									182	230				305	312			
			B	118	118	33.2	150	243		27.6	24.9										
			C	208	432	28.4	147	177		27.3	25.6										
			D	168	242	28.6	143	223		27.1	25.0										
		3	A	145	155	27.4	147	187	0.57	28.7	26.0										
			A1									157	273	0.79	27.0	26.3	312	355		24.4	23.1
			A2									163	187				382	332			
			A3									210	183				325	358			
			B	250	262	29.6	152	247		28.1	24.8										
			C	132	318	31.2	167	250		27.4	24.3										
			D	212	270	27.3	143	217		26.9	23.7										
		4	A	130	230	31.5	153	220		28.4	26.3										
			A1									157	173				350	608		23.0	18.9
			A2									180	187				325	400			
			A3									142	150				345	392			
			B	108	132	32.3	173	193	0.45	29.3	26.5										
			C	125	208	31.8	160	237		30.4	26.5										
			D	132	220	31.3	167	217		29.2	26.2										
		5	A	95	168	30.0	140	177	0.42	29.8	27.1										
			A1									160	227	0.54	29.7	26.6	308	392		23.7	20.5
			A2									153	150				320	350			
			A3									142	190				258	325			
			B	168	258	23.9	100	132	0.73	29.2	27.4										
			C	138	192	30.7	97	157	0.61	30.5	27.4										
			D	142	180	30.0	113	125	0.55	31.0	26.5										
										Henry Soil Series											
M VI	HN1	1	A	120	208	29.4	127	145		30.0	34.5										
			A1									135	147	0.32	31.2	28.2	168	230	0.37	31.8	33.2
			A2									193	145				195	305			
			A3									128	125				138	150			
			B	130	195	32.2	122	101		30.0	35.2										
			C	138	150	30.1	145	190		31.0	32.8										
			D	145	108	30.7	162	139		31.2	34.4										
		2	A	208	155	32.3	183	171	0.23	31.3	27.4										
			A1									165	138				230	245		32.1	35.5
			A2									128	110				250	275			
			A3									153	100				270	220			
			B	180	112	32.9	164	172	0.31	31.6	26.5										
			C	188	245	36.4	128	108	0.38	33.1	28.9										
			D	218	158	32.8	155	148	0.22	32.7	28.0										
										Collins Soil Series											
C III	C1	1	A	208	218	30.2	213	223	0.73	30.3	29.7										
			A1									162	212	0.67	30.7	30.0	192	242		27.1	26.8
			A2									178	202				270	345			
			A3									208	157				295	320			
			B	182	142	29.1	156	182	0.81	30.5	30.1										
			C	155	255	30.8	209	278		31.0	30.1										
			D	125	130	30.4	200	203	0.68	31.0	29.1										
		2	A	142	220	31.2	178	163		30.5	28.2										
			A1									156	200				132	145		26.6	24.6
			A2									167	177				168	232			
			A3									168	185				188	238			
			B	125	208	31.0	198	235		29.4	28.5										
			C	142	138	30.7	237	227		28.2	28.8										
			D	158	182	31.7	183	229		29.9	29.2										
		3	A	150	225	30.3	161	177		29.3	28.2										
			A1									155	140		29.8	28.6	150	238	1.14	27.1	26.8
			A2									192	247				188	230			
			A3									275	208				155	230			
			B	150	238	29.1	187	219		28.7	28.0										
			C	182	238	31.0	150	193		28.5	27.5										
			D	95	130	31.8	145	162		28.5	28.8										

(Continued)

Table A1 (Continued)

Identification				Visit A			Visit B					Visit C					Visit D				
				CI		MC	CI		RI	MC		CI		RI	MC		CI		RI	MC	
Site	Plot	Row	Position	0-6	6-12	0-6	0-6	6-12	6-12	0-6	6-12	0-6	6-12	6-12	0-6	6-12	0-6	6-12	0-6	0-6	6-12
											Collins Soil Series (Continued)										
C III	C1	4	A	152	138	30.0	74	241		29.3	26.6										
			A1									103	215				132	145		26.6	24.6
			A2									118	200				168	232			
			A3									115	180				188	238			
			B	142	138	28.2	204	208		27.8	27.1										
			C	162	192	27.2	186	181		27.6	27.1										
			D	125	208	28.4	187	215		27.8	27.0										
		5	A	122	192	28.5	179	211		27.3	27.4										
			A1									150	163		30.4	28.9	150	238		24.1	23.5
			A2									142	163				188	230			
			A3									142	137				155	230			
			B	82	188	29.1	171	253		29.3	26.3										
			C	142	210	25.9	155	175		27.9	27.6										
			D	118	195	30.0	155	206		30.0	26.6										
C I	C2	2	A	282	382	42.0	262	300		31.5	28.8										
			A1									270	222				338	308		28.8	28.4
			A2									255	222				325	220			
			A3									222	203				292	275			
			B	300	358	31.1	240	300		31.9	28.0										
			C	175	225	33.0	267	300		29.9	28.3										
			D	225	238	30.2	232	300		31.1	28.2										
		3	A	242	250	31.7	262	300		31.4	28.5										
			A1									245	290		28.8	27.4	288	305		28.5	27.1
			A2									237	283				282	300			
			A3									222	250				382	392			
			B	175	218	32.5	152	194		32.1	30.7										
			C	182	282	31.4	200	300		31.2	28.3										
			D	275	268	30.5	260	300		29.1	28.5										
		4	A	262	305	30.8	245	300		30.6	28.8										
			A1									203	212				370	392		28.3	26.7
			A2									167	220				430	470			
			A3									202	210				338	420			
			B	205	318	28.6	257	300		32.6	28.8										
			C	282	408	29.8	203	300		29.9	28.9										
			D	218	318	29.6	270	300		30.8	28.0										
F II	C3	1	A	82	142	31.6	133	157		28.6	27.2										
			A1									100	140	0.60	28.3	27.2	145	425		24.2	21.2
			A2									117	180				170	275			
			A3									85	205				168	308			
			B	63	80	30.6	187	160		27.5	28.0										
			C	88	132	33.6	120	133	0.35	27.8	27.8										
			D	55	120	33.5	153	223		28.8	28.8										
		3	A	55	180	32.8	160	217		27.5	27.8										
			A1									142	202		27.1	28.4	308	392		21.2	16.6
			A2									143	207				295	355			
			A3									138	155				258	392			
			B	62	175	32.5	147	180		26.6	27.2										
			C	42	145	32.0	180	205		28.0	30.9										
			D	68	182	31.8	220	263		26.5	27.5										
											Falaya Soil Series										
F VII	F1	1	A	192	208	27.0	140	115	0.67	27.8	27.9										
			A1									177	183	0.46	27.6	28.6	142	268		24.5	24.5
			A2									153	140				182	255			
			A3									178	162				175	168			
			B	195	280	26.8	142	190	0.32	27.6	27.7										
			C	145	212	27.7	127	173	0.64	27.9	29.0										
			D	300	320	28.3	160	207		30.1	28.8										
		2	A	212	392	28.5	118	250		29.9	26.9										
			A1									143	188				188	238		26.7	29.4
			A2									172	185				150	245			
			A3									147	192				232	262			
			B	120	280	29.7	123	257		29.3	26.4										
			C	158	258	30.4	192	300	0.51	28.7	26.2										
			D	52	238	29.2	180	230		31.2	26.9										
		3	A	225	350	30.5	147	300		29.6	26.6										
			A1									157	247	0.84	30.2	26.8	195	355	0.72	26.8	27.7
			A2									150	225				205	295			
			A3									142	215				250	350			
			B	125	270	27.2	177	233		28.1	27.7										
			C	212	312	29.1	152	300		31.2	27.6										
			D	120	280	31.8	133	220	0.57	31.5	27.9										

(Continued)

Table A1 (Continued)

Identification				Visit A			Visit B					Visit C					Visit D				
			Posi-	CI		MC	CI		RI	MC		CI		RI	MC		CI		RI	MC	
Site	Plot	Row	tion	0-6	6-12	0-6	0-6	6-12	6-12	0-6	6-12	0-6	6-12	6-12	0-6	6-12	0-6	6-12	0-6	0-6	6-12
Falaya Soil Series (Continued)																					
F VII	F1	4	A	118	208	30.7	138	300		30.1	28.8										
			A1									163	220				175	292		28.1	26.5
			A2									170	182				218	420			
			A3									120	183				212	355			
			B	80	192	30.5	163	300	0.48	30.4	27.8										
			C	182	270	30.2	150	227		31.8	26.6										
			D	132	175	31.1	140	168	0.34	29.3	29.4										
		5	A	92	170	34.4	187	293		28.9	28.0										
			A1									152	260		30.7	27.1	162	308		29.1	26.8
			A2									138	270				155	260			
			A3									145	273				180	300			
			B	115	318	31.0	168	293		30.4	28.8										
			C	108	280	31.6	168	300		32.6	29.2										
			D	160	200	30.2	128	192		32.5	28.1										
C VI	F2	1	A	368	750	30.4	193	287		30.0	29.7										
			A1									203	300		26.8	24.9	312	362		30.4	28.5
			A2									193	300				270	280			
			A3									207	300				312	330			
			B	282	300	28.5	193	300		30.0	29.7										
			C	200	232	31.6	187	287		32.8	30.7										
			D	312	375	28.7	143	223		31.0	29.5										
		2	A	162	188	34.6	143	183		32.9	31.0										
			A1									130	200				268	395		29.3	27.0
			A2									150	183				270	305			
			A3									180	237				295	280			
			B	158	188	32.8	140	157		31.4	29.8										
			C	145	192	32.8	173	207		31.9	30.5										
			D	142	200	34.0	143	240		32.8	26.8										
		3	A	170	282	30.7	177	247		30.4	28.2										
			A1									143	233		30.5	28.3	180	208		29.1	26.9
			A2									170	233				232	258			
			A3									147	260				262	495			
			B	[illegible]	275	[illegible]	257	257		32.2	28.6										
			C	132	275	34.0	173	287		32.2	28.6										
			D	212	242	30.6	193	247		32.2	27.7										
		4	A	158	392	31.3	163	297		30.7	27.5										
			A1									120	247				232	612		30.5	24.4
			A2									140	280				288	625			
			A3									123	243				258	650			
			B	142	342	31.2	177	287		33.8	26.0										
			C	175	220	32.1	133	247		34.2	27.6										
			D	170	275	32.0	167	277		30.6	26.5										
		5	A	162	330	26.9	207	300	0.57	29.2	26.8										
			A1									260	300		27.6	27.0	292	570		24.4	25.8
			A2									240	300				405	542			
			A3									190	273				355	580			
			B	362	518	26.8	223	300		29.2	29.1										
			C	258	530	27.3	140	247		29.9	21.1										
			D	175	318	27.2	173	287		31.4	18.5										
C IV	F[illegible]	1	A	130	125	32.4	42	37	0.56	37.1	32.4										
			A1									47	80	0.49	32.1	31.5	50	138	0.61	31.5	29.8
			A2									30	67				80	158			
			A3									38	62				75	95			
			B	158	158	31.5	18	45	0.49	33.5	32.1										
			C	125	130	31.8	27	93	0.51	33.9	31.2										
			D	120	162	31.5	55	103	0.40	35.2	28.8										
		2	A	168	212	33.4	45	115	0.48	33.5	30.8										
			A1									33	77				50	158		32.3	29.3
			A2									30	82				75	170			
			A3									32	97				62	168			
			B	138	170	32.8	30	70	0.39	32.1	32.4										
			C	188	150	33.1	35	48	0.57	35.3	29.9										
			D	138	118	34.8	17	68	0.37	36.1	36.4										
		3	A	180	205	32.7	53	53	0.40	33.4	31.0										
			A1									17	40	0.37	35.2	33.6	82	195	0.39	29.9	29.6
			A2									23	40				70	100			
			A3									13	55				85	138			
			B	160	195	30.1	30	60	0.37	32.8	37.5										
			C	150	168	29.6	73	167	0.46	31.4	29.3										
			D	145	130	31.1	30	55	0.37	35.5	30.0										
		4	A	130	188	29.7	37	50	0.59	35.1	30.7										
			A1									47	92				80	195		30.1	29.7
			A2									42	92				132	268			
			A3									43	125				112	220			
			B	142	132	31.1	38	73	0.42	31.8	29.1										
			C	132	148	31.9	48	82	0.55	31.5	30.7										
			D	155	170	29.6	37	87	0.50	32.5	26.9										

(Continued)

Table A1 (Continued)

Identification				Visit A			Visit B					Visit C					Visit D				
				CI		MC	CI		RI	MC		CI		RI	MC		CI		RI	MC	
Site	Plot	Row	Position	0-6	6-12	0-6	0-6	6-12	6-12	0-6	6-12	0-6	6-12	6-12	0-6	6-12	0-6	6-12	0-6	0-6	6-12
											Falaya Soil Series (Continued)										
C IV	F3	5	A	168	162	28.8	38	75	0.24	31.8	31.6										
			A1									53	92	0.66	35.7	34.6	55	168	0.59	27.8	27.9
			A2									38	52				45	188			
			A3									40	78				82	212			
			B	132	158	28.5	28	80	0.56	30.1	30.1										
			C	142	192	29.2	52	90	0.47	31.1	30.5										
			D	108	182	29.0	42	75	0.57	30.9	30.6										
F VIII	F4	1	A	132	182	36.2	106	157	0.41	36.0	33.6										
			A1									90	103	0.41	37.2	35.4	145	205	0.49	31.9	32.8
			A2									90	112				138	195			
			A3									87	103				130	192			
			B	88	108	42.0	88	108	0.32	35.3	32.7										
			C	70	125	34.5	83	122	0.47	38.5	32.9										
			D	82	232	37.2	123	140	0.87	35.5	38.3										
		2	A	70	145	35.2	90	167	0.29	34.4	29.8										
			A1									90	150				105	168		34.7	33.3
			A2									90	170				125	138			
			A3									97	157				108	218			
			B	50	158	40.6	125	233	0.42	34.1	33.0										
			C	58	188	37.5	90	230	0.48	35.4	30.2										
			D	95	238	39.4	110	187	0.52	35.9	29.5										
		3	A	68	150	39.6	90	177	0.49	33.1	28.1										
			A1									107	218	0.52	32.6	26.6	130	212	0.55	30.9	27.9
			A2									120	203				132	220			
			A3									100	147				150	258			
			B	65	138	37.2	112	220	0.51	31.3	24.4										
			C	70	220	42.0	67	185	0.64	37.4	29.7										
			D	30	155	40.4	120	187	0.47	31.5	23.6										
		4	A	118	292	35.4	138	203	0.65	31.3	27.3										
			A1									110	212				118	270		27.5	26.2
			A2									103	200				118	175			
			A3									117	203				120	230			
			B	20	130	27.1	80	103	0.41	28.0	26.3										
			C	112	232	21.2	107	152	0.34	28.1	28.4										
			D	70	192	31.7	118	155	0.46	31.1	32.4										
C V	F5	1	A	68	195	35.0	145	197	0.69	30.4	29.4										
			A1									120	277	0.92	31.4	28.4	342	362		26.9	25.4
			A2									147	213				232	308			
			A3									120	190				330	412			
			B	232	358	30.5	133	148	0.56	30.0	31.7										
			C	220	208	31.7	143	16[illegible]	0.60	34.1	29.2										
			D	242	200	30.8	92	170	0.88	30.3	29.5										
		2	A	150	142	35.3	117	208	0.57	33.2	29.6										
			A1									140	157				280	312		26.3	26.8
			A2									140	200				200	358			
			A3									135	127				258	332			
			B	95	150	31.7	142	227	0.51	30.1	26.5										
			C	70	262	33.6	98	243	0.57	32.8	28.4										
			D	120	275	29.6	133	147	0.59	29.8	29.3										
		3	A	218	305	32.6	135	207	0.70	31.6	31.1										
			A1									205	278	0.80	27.7	27.7	232	332		25.4	26.8
			A2									252	270				350	392			
			A3									157	273				305	342			
			B	180	338	34.0	175	287	0.71	33.9	28.9										
			C	205	282	29.0	147	278	0.78	30.4	28.0										
			D	80	188	33.3	82	197	0.71	29.5	28.8										
		4	A	215	255	30.6	152	197	0.42	30.1	30.5										
			A1									140	180				250	395		22.1	19.8
			A2									120	163				245	500			
			A3									177	177				258	450			
			B	182	230	32.4	127	210	0.73	29.9	28.7										
			C	158	292	32.4	145	260	0.68	29.9	27.5										
			D	132	268	34.2	143	210	0.67	30.1	29.3										
F II	F6	2	A	120	230	29.0	157	167		29.1	28.1										
			A1									120	187				218	318		23.5	24.5
			A2									138	173				168	238			
			A3									113	207				255	255			
			B	82	192	32.5	187	150	0.57	28.7	28.6										
			C	62	100	30.2	193	153	0.36	29.1	29.7										
			D	82	225	29.6	153	227		30.7	28.1										
		4	A	52	138	33.8	163	143	0.49	28.5	31.3										
			A1									133	143				232	288		24.5	25.1
			A2									127	163				258	275			
			A3									120	130				225	250			
			B	58	158	33.6	128	142	0.45	27.7	29.9										
			C	52	158	32.8	147	133	0.42	27.8	29.8										
			D	70	170	33.4	173	150	0.46	28.5	29.6										

(Continued)

Table A1 (Concluded)

Identification				Visit A			Visit B					Visit C					Visit D				
				CI		MC	CI		RI	MC		CI		RI	MC		CI		RI	MC	
Site	Plot	Row	Position	0-6	6-12	0-6	0-6	6-12	6-12	0-6	6-12	0-6	6-12	6-12	0-6	6-12	0-6	6-12	0-6	0-6	6-12
										Falaya Soil Series (Continued)											
F II	F6	5	A	128	208	35.4	155	185	0.54	28.9	28.5										
			A1									138	145	0.71	28.4	29.0	318	342		21.4	18.6
			A2									118	150				375	425			
			A3									133	153				250	368			
			B	62	138	33.2	120	157	0.45	31.1	29.9										
			C	35	168	33.2	113	148	0.42	28.9	29.1										
			D	30	162	34.0	100	170	0.42	29.2	29.7										
C I	F7	1	A	182	375	39.0	255	300		29.2	28.4										
			A1									270	262		31.3	28.1	300	382		29.6	26.8
			A2									252	265				292	305			
			A3									252	292				288	292			
			B	268	325	35.9	203	227		32.4	29.0										
			C	232	308	29.8	272	300		29.4	29.6										
			D	182	325	38.8	245	300		31.4											
		5	A	232	332	29.5	265	300		30.5	32.0										
			A1									250	300		28.9	30.4	300	275		28.4	30.4
			A2									270	300				355	238			
			A3									267	300				325	245			
			B	242	308	30.9	233	300		39.4	29.7										
			C	225	425	30.4	242	300		23.7	28.6										
			D	158	292	29.6	212	300		26.5	28.6										
										Hymon Soil Series											
C II	HY1	1	A	175	158	31.8	133	137	0.28	34.6	30.1										
			A1									150	130	0.33	32.9	31.7	162	175	0.65	29.4	26.7
			A2									122	140				155	145			
			A3									123	117				192	200			
			B	150	150	30.6	143	167		32.2	26.8										
			C	175	142		123	132	0.46	33.0	27.4										
			D	182	182	32.5	120	125	0.32	33.9	32.9										
		2	A	242	275	34.9	178	300		37.2	30.3										
			A1									195	173				170	358		35.2	29.7
			A2									197	232				182	350			
			A3									217	245				168	503			
			B	300	280	36.3	155	215		37.7	30.0										
			C	158	158	40.6	180	300	0.30	39.2	32.8										
			D	292	308	35.6	188	300	0.42	36.8	32.1										
		3	A	232	308	34.4	185	300	0.77	33.3	26.9										
			A1									168	167	0.53	31.8	29.5	230	368		27.6	24.9
			A2									172	202				280	332			
			A3									183	233				345	342			
			B	218	192	32.3	213	158	0.64	34.3	28.8										
			C	218	150	31.6	155	100	0.21	34.6	31.1										
			D	242	232	37.3	123	163	0.14	33.0	30.6										
		4	A	208	342	35.2	152	295	0.15	30.1	26.9										
			A1									157	183				245	245		26.1	24.0
			A2									175	192				188	188			
			A3									152	152				318	270			
			B	232	250	30.0	182	127	0.33	29.3	27.3										
			C	168	153	28.8	188	148	0.13	28.0	26.3										
			D	168	250	31.2	195	297	0.08	29.9	25.9										
		5	A	168	182	25.8	150	178	0.17	29.6	27.9										
			A1									135	118	0.16	28.9	27.0	195	255	0.52	26.1	24.1
			A2									138	153				192	205			
			A3									165	157				182	192			
			B	175	168	26.9	183	123	0.23	26.8	28.2										
			C	318	382	26.0	220	190	0.35	26.8	26.1										
			D	192	192	26.5	187	300	0.55	28.8	27.4										

Table A2

Classification and Properties of Soils at Test Sites*

Site	Plot	Row	Position	Classification USDA 0-6	Classification USDA 6-12	Classification USCS 0-6	Classification USCS 6-12	Grain-Size Analysis, % USDA Sand 0-6	Sand 6-12	Silt 0-6	Silt 6-12	Clay 0-6	Clay 6-12	USCS Fines 0-6	Fines 6-12	Atterberg Limits LL 0-6	LL 6-12	PL 0-6	PL 6-12	PI 0-6	PI 6-12	Dry Density g/cc 0-6	Dry Density g/cc 6-12	Specific Gravity 0-6	Specific Gravity 6-12	Soil Moisture, %, at Saturation 0-6	Saturation 6-12	0.015-atm Tension 0-6	0.015-atm Tension 6-12	0.03-atm Tension 0-6	0.03-atm Tension 6-12	0.06-atm Tension 0-6	0.06-atm Tension 6-12
																Alluvial Fill																	
M I	AF1	1	A	SiL	SiL	ML	CL	14	12	67	65	19	23	99.0	98.0	38	35	26	23	12	12	1.36	1.36	2.69	2.71	32.6	32.1	31.3	30.8	30.8	30.3	29.9	29.2
			B	SiL	SiL	ML	ML	15	9	69	74	16	17	98.8	99.4	31	29	24	23	7	6	1.34	1.41	2.68	2.71	33.0	30.4	31.3	29.7	30.7	29.2	29.9	28.6
			C	SiL	SiL	ML	ML	11	13	73	73	16	14	99.6	99.6	33	30	25	25	8	5	1.28	1.40	2.68	2.70	33.2	28.9	31.6	27.8	30.7	27.2	29.8	26.5
			D	SiL	SiL	CL	CL	10	10	64	72	26	18	99.6	99.8	35	33	23	22	12	11	1.50	1.42	2.69	2.71	28.4	34.0	27.8	32.4	27.2	31.2	26.7	30.0
		2	A	SiL	SiL	ML	ML	12	12	77	75	11	13	99.4	99.6	33	31	30	26	5	5	1.24	1.40	2.69	2.70	42.0	31.4	40.4	30.7	39.4	30.1	38.0	29.4
			B	SiL	SiL	ML	ML	10	11	77	77	13	12	99.4	99.8	34	32	27	26	7	6	1.36	1.41	2.68	2.71	34.5	32.0	33.6	31.0	32.8	30.3	32.0	29.6
			C	SiL	SiL	ML	ML	10	12	74	76	16	12	98.4	99.6	36	31	27	26	9	5	1.36	1.35	2.69	2.70	32.6	34.3	32.2	31.8	31.8	31.0	31.2	30.0
			D	SiL	SiL	ML	ML	9	14	74	73	17	13	99.4	99.4	48	32	31	26	17	6	1.35	1.40	2.69	2.70	33.4	31.6	32.7	30.8	32.2	30.2	31.6	29.5
		3	A	SiL	SiL	ML	ML	15	14	73	77	12	9	98.6	99.6	36	26	28	26	8	0	1.40	1.51	2.68	2.70	32.4	26.8	31.3	26.0	30.6	25.6	30.0	25.0
			B	SiL	SiL	CL	ML	12	16	75	76	13	8	98.6	99.4	38	27	25	26	13	1	1.30	1.43	2.68	2.69	35.6	29.6	34.7	29.1	34.2	28.6	33.6	28.0
			C	SiL	SiL	ML	ML	12	15	76	75	12	10	98.2	98.4	33	27	26	25	7	2	1.32	1.46	2.69	2.70	36.6	28.8	33.2	28.2	34.0	27.8	33.2	27.2
			D	SiL	SiL	ML	ML	11	10	76	79	13	11	98.8	99.8	36	32	27	24	9	8	1.34	1.46	2.68	2.71	35.3	29.6	34.6	29.2	34.0	28.8	33.5	28.0
		4	A	SiL	SiL	ML	ML	10	9	73	74	17	17	99.0	99.8	37	30	27	24	10	6	1.30	1.48	2.69	2.71	38.4	26.4	37.2	26.0	36.6	25.8	35.7	25.2
			B	SiL	SiL	ML	ML	11	9	79	73	10	18	99.0	99.6	33	32	27	23	6	9	1.43	1.48	2.60	2.71	30.6	29.0	29.8	28.6	29.4	28.1	28.9	27.9
			C	SiL	SiL	ML	ML	14	14	77	73	9	[illegible]	99.0	99.2	40	27	30	24	10	3	1.41	1.44	2.68	2.70	31.2	30.7	30.2	29.1	29.8	27.8	29.2	27.3
			D	SiL	SiL	ML	ML	12	10	77	78	11	12	97.8	99.6	37	29	28	25	9	4	1.29	1.49	2.68	2.71	38.0	29.2	36.9	28.5	36.2	27.9	35.4	27.3
		5	A	SiL	SiL	ML	ML	12	12	75	78	13	10	98.0	99.6	41	30	30	28	11	2	1.31	1.42	2.68	2.70	37.0	32.2	35.1	30.2	34.5	29.2	33.6	28.6
			B	SiL	SiL	ML	ML	15	10	74	75	11	15	98.8	99.4	31	29	25	23	6	6	1.37	1.48	2.68**	2.71**	33.8	27.0	32.4	26.0	31.6	25.5	36.9	25.0
			C	SiL	SiL	ML	ML	12	13	74	74	14	13	98.2	98.8	41	30	30	25	11	5	1.27	1.47	2.69	2.70	38.3	27.1	36.2	26.6	35.4	26.4	34.4	26.0
			D	SiL	SiL	ML	ML	13	10	74	75	13	15	98.6	99.6	36	29	26	24	10	5	1.34	1.42	2.68	2.71	34.6	29.4	33.6	28.7	33.0	28.4	32.0	27.4
M V	AF2	2	A	SiL	SiL	ML	CL	15	14	73	72	12	14	99.0	99.0	33	32	28	23	5	9	1.40	1.42	2.66	2.69	32.2	31.6	30.9	30.6	30.6	29.9	30.0	29.2
			B	SiL	SiL	ML	CL	14	12	76	72	10	16	98.8	99.2	37	31	28	22	9	9	1.44	1.50	2.66	2.69	30.1	28.2	29.2	27.0	28.7	26.6	28.2	26.0
			C	SiL	SiL	ML	CL	16	11	75	71	9	18	97.2	99.6	32	33	25	21	7	12	1.40	1.46	2.66	2.69	31.0	29.2	29.8	28.2	29.3	27.4	28.8	26.9
			D	SiL	SiL	ML	CL	15	11	75	68	10	21	97.6	99.4	31	40	23	21	8	19	1.44	1.49	2.66	2.70	29.2	27.4	28.4	26.7	27.9	26.4	27.4	26.2
		3	A	SiL	SiL	ML	ML	12	9	78	77	10	14	98.6	98.8	43	29	33	24	10	5	1.37	1.36	2.66	2.69	33.8	37.2	32.4	34.4	32.0	33.6	31.5	32.6
			B	SiL	SiL	ML	ML	12	10	78	76	10	14	99.0	98.6	35	33	28	26	7	7	1.39	1.39	2.66	2.69	32.8	33.8	31.5	32.3	31.0	31.8	30.4	31.1
			C	SiL	SiL	ML	ML	12	10	79	77	9	13	[illegible]	99.0	35	33	28	25	8	8	1.42	1.47	2.66	2.69	30.7	30.2	29.7	29.0	29.4	28.6	28.8	28.2
			D	SiL	SiL	ML	ML	13	10	79	77	8	13	98.8	99.4	26	31	24	23	2	8	1.44	1.44	2.66	2.69	30.6	31.8	29.2	29.8	28.8	28.6	28.2	28.6
		4	A	SiL	SiL	ML	CL	12	10	79	75	9	15	99.0	99.4	36	35	28	24	8	11	1.42	1.42	2.66	2.70	32.7	31.2	30.8	30.0	30.4	29.2	29.8	28.7
			B	SiL	SiL	ML	CL	12	10	78	74	10	16	99.0	99.2	35	29	28	22	7	7	1.42	1.44	2.66	2.70	32.6	31.2	30.9	29.4	30.6	28.8	29.8	28.2
			C	SiL	SiL	ML	CL	12	10	79	73	9	17	98.8	99.4	34	29	25	21	9	8	1.40	1.46	2.66	2.70	32.8	30.6	31.4	28.8	31.0	28.0	30.4	27.6
			D	SiL	SiL	ML	CL	13	10	77	76	10	14	98.0	99.4	36	30	27	20	9	10	1.40	1.44	2.66	2.70	32.8	31.9	31.6	30.1	31.2	29.4	30.5	28.9
																Memphis Soil Series																	
M IV	M1	1	A	SiL	SiCL	CL	CH	12	8	70	62	18	30	99.6	99.8	41	54	25	27	16	27	1.44	1.48	2.66**	2.71	30.1	30.0	28.6	28.6	28.4	28.4	27.9	28.2
			B	SiCL	SiCL	CL	CH	7	7	64	62	29	31	99.8	99.8	49	54	24	29	25	25	1.46	1.50	2.69	2.71	29.3	28.5	28.3	27.8	28.0	27.8	27.6	27.8
			C	SiL	SiCL	CL	CL	11	8	69	63	20	29	99.4	99.8	36	48	23	27	13	21	1.50	1.48	2.69	2.71	28.4	29.0	27.4	28.2	27.1	28.2	26.8	27.6
			D	SiL	SiCL	CL	CH	12	6	65	66	23	28	99.4	100.0	40	54	25	25	15	29	1.42	1.50	2.69	2.71	31.0	28.6	29.6	27.7	29.1	27.7	28.6	27.6

(Continued)

Note: "0-6" and "6-12" indicate 0- to 6-in. and 6- to 12-in. soil layers, respectively.
* Data are listed by plots according to field-identified soil series.
** Estimated.

Table A2 (Continued)

Site	Plot	Row	Position	Classification USDA 0-6	Classification USDA 6-12	Classification USCS 0-6	Classification USCS 6-12	Grain-Size Analysis, % USDA Sand 0-6	Sand 6-12	Silt 0-6	Silt 6-12	Clay 0-6	Clay 6-12	USCS Fines 0-6	Fines 6-12	Atterberg Limits LL 0-6	LL 6-12	PL 0-6	PL 6-12	PI 0-6	PI 6-12	Dry Density g/cc 0-6	Dry Density 6-12	Specific Gravity 0-6	Specific Gravity 6-12	Soil Moisture, %, at Saturation 0-6	Saturation 6-12	0.015-atm Tension 0-6	0.015-atm Tension 6-12	0.03-atm Tension 0-6	0.03-atm Tension 6-12	0.06-atm Tension 0-6	0.06-atm Tension 6-12
																Memphis Soil Series (Continued)																	
M IV	M1	2	A	SiL	SiL	ML	CL	13	14	74	67	13	19	99.4	99.6	26	38	24	23	2	15	1.40	1.44	2.66	2.69	33.8	29.8	31.6	28.9	30.6	27.8	30 0	27.
			B	SiL	SiL	ML	CL	12	14	70	71	18	15	99.2	99.8	28	42	25	22	3	20	1.40	1.52	2.68	2.69	32.2	29.7	30.7	26.2	29.7	26.0	29.3	25.[illegible]
			C	SiL	SiCL	CL	CL	12	6	68	63	20	31	99.6	99.8	34	49	22	24	12	25	1.51	1.50	2.69	2.71	27.6	28.4	27.0	28.2	26.6	28.0	26.3	27.8
			D	SiL	SiL	ML	CH	11	8	72	66	17	26	99.4	99.8	33	52	25	25	8	27	1.38	1.44	2.68	2.71	33.2	30.5	30.6	29.2	29.8	29.0	28.9	28.6
		3	A	SiL	SiL	CL	ML	12	15	70	73	18	12	99.4	99.8	36	41	22	26	14	15	1.48	1.52	2.66	2.68	29.0	28.5	27.2	27.0	26.8	26.8	26.3	26.6
			B	SiL	SiCL	ML	CL	13	8	73	65	14	27	99.0	99.8	32	48	23	25	9	23	1.46	1.52	2.67	2.70	29.6	28.0	28.0	26.9	27.2	26.6	26.6	26.2
			C	SiL	SiCL	ML	ML	12	8	74	64	14	28	99.4	99.8	31	45	24	28	7	17	1.47	1.54	2.67	2.71	28.0	27.4	26.9	26.6	26.4	26.3	26.2	26.3
			D	SiL	SiL	ML	ML	13	9	72	66	15	25	99.4	99.8	29	48	23	28	6	20	1.48	1.52	2.67	2.70	28.4	28.6	27.7	27.8	27.0	27.6	26.8	27.4
		4	A	SiL	SiCL	ML	ML	15	8	75	63	10	29	99.4	99.8	30	44	25	27	5	17	1.38	1.46	2.66	2.70	32.0	29.4	29.9	28.5	29.0	28.0	28.6	27.6
			B	SiL	SiL	ML	ML	9	12	76	73	15	15	99.2	99.6	29	36	25	27	4	9	1.48	1.48	2.67	2.69	28.8	30.0	27.7	29.2	27.1	28.8	26.6	28.6
			C	SiL	SiCL	ML	CL	7	8	68	62	25	30	99.8	99.8	32	47	24	24	8	23	1.46	1.47	2.68	2.71	29.1	30.0	27.8	29.0	27.4	28.8	27.0	28.7
			D	SiL	SiL	ML	CL	8	12	70	65	22	23	99.6	99.8	32	47	24	27	8	20	1.40	1.46	2.67	2.70	31.2	30.4	29.1	29.3	28.5	29.0	28.0	27.7
		5	A	SiL	SiL	ML	CL	14	9	75	69	11	22	98.2	99.0	31	38	23	24	8	14	1.51	1.44	2.66	2.69	28.4	30.3	27.3	29.5	26.6	28.8	26.4	28.4
			B	SiL	SiL	ML	CL	12	10	76	67	12	23	99.2	99.2	28	37	24	23	4	14	1.47	1.46	2.66	2.70	30.0	29.8	28.9	28.8	28.2	28.3	27.8	27.9
			C	SiL	SiL	ML	CL	14	8	77	69	9	23	98.6	99.0	30	40	24	24	6	16	1.47	1.47	2.66	2.70	30.2	28.9	28.8	28.2	28.0	27.6	27.6	27.2
			D	SiL	SiL	ML	CL	15	9	74	70	11	21	98.8	99.0	31	34	23	21	8	13	1.47	1.42	2.66	2.69	29.5	30.9	28.4	30.4	27.6	29.5	27.2	29.2
M III	M2	1	A	SiL	SiL	ML	CL	12	13	79	77	9	10	98.4	99.6	26	35	26	22	0	13	1.38	1.41	2.64	2.67	34.0	31.4	31.7	29.6	30.8	28.6	30.4	28.1
			B	SiL	SiCL	ML	CL	13	9	77	64	10	27	99.4	99.8	31	32	30	23	1	9	1.44	1.46	2.64	2.67	30.6	29.6	29.2	28.6	28.4	27.6	28.0	27.3
			C	SiL	SiL	ML	CL	13	12	77	72	10	16	98.8	99.6	27	36	26	23	1	13	1.38	1.45	2.64	2.67	32.7	30.4	30.5	29.0	29.6	28.2	28.9	27.8
			D	SiL	SiL	ML	CL	8	11	69	72	23	17	99.0	99.6	29	40	25	22	4	18	1.46	1.43	2.66	2.68	29.3	31.0	27.8	29.7	27.0	28.8	26.5	28.2
		2	A	SiL	SiL	ML	CL	10	11	81	78	9	11	98.0	98.8	26	31	25	22	1	9	1.42	1.38	2.64	2.67	31.8	32.0	29.9	30.4	29.0	29.0	28.6	28.6
			B	SiL	SiL	ML	ML	13	12	79	78	8	10	97.6	99.0	26	28	29	23	3	5	1.38	1.42	2.64	2.67	32.4	31.0	30.6	29.0	29.4	27.8	29.0	27.4
			C	SiL	SiL	ML	ML	13	9	77	73	10	18	99.0	99.4	30	30	27	24	3	6	1.42	1.43	2.64	2.67	32.2	31.2	30.4	29.6	29.0	28.2	28.6	27.9
			D	SiL	SiL	ML	CL	13	14	78	77	9	9	98.6	99.6	29	41	29	25	0	16	1.43	1.44	2.64	2.67	30.0	31.8	28.5	30.2	27.6	29.6	27.4	29.2
		3	A	SiL	SiL	ML	CL	13	10	77	73	10	17	98.2	99.6	30	38	25	22	5	16	1.46	1.51	2.64	2.67	30.0	28.4	28.[illegible]	27.4	27.8	26.6	27.4	26.4
			B	**	**	ML	CL	12	10	78	69	10	21	98.0	99.8	29	37	24	23	5	14	1.44	1.45	2.64	2.67	29.8	29.2	28.0	28.0	27.4	26.9	26.9	26.2
			C	SiL	SiL	ML	CL	12	11	77	71	11	18	99.2	99.6	32	38	26	23	6	15	1.40	1.51	2.64	2.67	32.2	28.6	30.2	27.6	29.2	27.0	28.8	26.8
			D	SiL	SiL	ML	CL	12	8	78	70	10	22	98.2	99.8	28	42	25	24	3	18	1.44	1.47	2.64	2.67	30.1	29.4	28.6	28.4	27.8	27.6	27.4	27.3
		4	A	SiL	SiL	ML	CL	12	11	76	75	12	14	99.6	99.4	33	43	28	22	5	21	1.44	1.49	2.64	2.67	30.0	29.0	28.4	28.3	27.4	27.8	27.0	27.6
			B	SiL	SiL	ML	CL	12	10	77	72	11	18	99.2	99.8	32	44	26	22	6	22	1.44	1.49	2.64	2.67	30.3	29.1	29.0	28.1	28.3	27.2	27.8	27.0
			C	SiL	SiL	ML	CL	12	10	78	70	10	20	98.8	99.2	29	43	24	22	5	21	1.46	1.46	2.64**	2.67**	29.5	29.4	27.5	28.4	26.8	27.6	26.4	27.3
			D	SiL	SiL	ML	CL	13	12	74	69	13	19	98.8	99.4	28	48	24	24	4	24	1.43	1.50	2.65	2.67	31.4	29.4	29.1	28.3	28.4	27.6	27.8	27.6
		5	A	SiL	SiL	ML	CL	12	9	75	67	13	24	99.6	99.6	29	41	24	24	5	17	1.40	1.48	2.64	2.67	32.9	30.1	30.1	29.0	29.2	28.5	28.6	28.2
			B	SiL	SiL	ML	CL	12	10	75	70	13	20	99.0	99.4	29	38	24	23	5	15	1.46	1.49	2.65	2.67	29.3	29.4	27.8	27.4	26.9	26.8	26.4	26.4
			C	SiL	SiL	ML	CL	12	9	78	71	10	20	99.0	99.6	32	46	27	21	5	25	1.42	1.52	2.64	2.67	31.2	28.0	29.6	27.1	28.8	26.8	28.2	26.6
			D	SiL	SiL	ML	CL	13	9	76	68	12	23	99.0	99.0	28	37	28	23	0	14	1.40	1.46	2.65	2.67	33.1	29.7	31.2	28.2	30.4	27.7	29.8	27.4
M VI	M3	4	A	SiL	SiL	ML	CL	11	9	72	69	17	22	99.6	99.8	32	44	24	25	8	19	1.46	1.46	2.67	2.71	28.0	29.6	26.9	28.8	27.0	29.0	26.4	28.7
			B	SiL	SiCL	ML	CL	11	8	69	62	20	30	99.0	99.6	34	48	24	26	10	22	1.49	1.44	2.68	2.71	27.3	30.2	26.0	30.0	25.8	29.7	25.2	29.2
			C	SiL	SiCL	ML	CH	9	8	67	63	24	29	99.8	99.8	34	56	24	25	10	31	1.52	1.58	2.69	2.71	26.1	28.1	24.9	27.2	24.8	27.2	24.3	26.9
			D	SiL	SiCL	ML	CH	10	9	68	63	22	28	99.6	99.8	34	55	25	24	9	31	1.54	1.54	2.69	2.71	26.1	26.6	25.2	25.9	25.0	26.0	24.6	25.6

(Continued)

** Estimated.

Table A2 (Continued)

Site	Plot	Row	Position	Classification USDA 0-6	Classification USDA 6-12	Classification UCS 0-6	Classification UCS 6-12	Grain-Size Analysis, % USDA Sand 0-6	Sand 6-12	Silt 0-6	Silt 6-12	Clay 0-6	Clay 6-12	UCS Fines 0-6	Fines 6-12	Atterberg Limits LL 0-6	LL 6-12	PL 0-6	PL 6-12	PI 0-6	PI 6-12	Dry Density g/cc 0-6	Dry Density g/cc 6-12	Specific Gravity 0-6	Specific Gravity 6-12	Soil Moisture, %, at Saturation 0-6	Saturation 6-12	0.015-atm Tension 0-6	0.015-atm Tension 6-12	0.03-atm Tension 0-6	0.03-atm Tension 6-12	0.06-atm Tension 0-6	0.06-atm Tension 6-12
														Memphis Soil Series (Continued)																			
M VI	M3	5	A	SiL	SiL	CL	CL	9	9	68	71	23	20	99.8	99.8	45	45	25	26	20	19	1.52	1.54	2.67	2.70	27.1	28.0	26.1	26.8	26.2	27.0	26.0	26.8
			B	SiL	SiL	CL	CL	11	9	67	70	22	21	99.4	99.6	36	47	24	24	12	23	1.46	1.52	2.69	2.71	29.6	28.0	28.4	27.0	28.4	27.2	27.6	26.7
			C	SiL	SiL	ML	ML	10	10	67	68	23	22	99.6	99.6	38	46	25	27	13	19	1.52	1.52	2.69**	2.71**	26.9	27.6	26.0	25.9	26.0	27.0	25.5	26.8
			D	SiL	SiL	CL	ML	10	30	67	68	23	22	99.8	99.8	39	46	25	27	14	19	1.50	1.50	2.69	2.70	27.0	30.3	25.5	28.4	25.4	28.2	24.8	27.6
M V	M4	1	A	SiL	SiL	ML	CL	11	9	71	69	18	22	99.0	99.6	41	43	28	25	13	18	1.44	1.48	2.66	2.71	30.0	27.8	29.4	27.5	29.1	27.4	28.8	27.1
			B	SiL	SiL	CL	CL	10	8	69	69	21	23	99.2	99.6	34	48	23	25	11	23	1.38	1.54	2.66**	2.71**	30.1	26.2	28.6	25.4	27.9	25.4	27.2	25.3
			C	SiL	SiL	ML	CL	13	9	74	67	13	24	99.0	99.6	32	45	27	24	5	21	1.48	1.55	2.66	2.71	27.4	26.2	26.5	25.6	26.1	25.6	25.6	25.4
			D	SiL	SiL	ML	CL	14	9	71	68	15	23	98.6	99.6	36	45	27	25	9	21	1.48	1.54	2.66	2.71	28.0	26.8	27.4	26.2	27.0	26.1	26.6	26.0
		5	A	SiL	SiCL	CL	CL	14	8	70	64	16	28	97.8	99.8	39	48	24	23	15	25	1.52	1.50	2.66	2.71**	26.2	27.5	25.2	26.8	25.2	26.8	24.9	26.6
			B	SiL	SiCL	CL	CH	16	9	70	63	14	28	96.8	99.8	42	52	22	25	20	27	1.38	1.48	2.66	2.71	33.4	28.4	31.4	27.6	30.6	27.6	30.6	27.4
			C	SiL	SiCL	CL	CH	15	8	68	62	17	30	97.6	99.8	38	53	22	25	16	28	1.51	1.50	2.66	2.71	26.6	28.2	25.8	27.4	25.5	27.4	25.4	27.1
			D	SiL	SiCL	CL	CL	11	8	63	64	26	28	99.0	99.6	34	46	23	25	11	21	1.51	1.46	2.68	2.71	27.1	29.6	26.2	28.8	26.0	28.8	25.7	28.6
														Loring Soil Series																			
L VI	L1	1	A	SiCL	SiCL	CL	CL	9	8	63	64	28	28	99.8	100.0	40	49	24	27	16	22	1.42	1.52	2.68	2.71	29.6	23.4	28.2	27.2	28.0	27.2	27.4	26.8
			B	SiL	SiCL	CL	CL	9	9	68	62	23	29	99.4	99.8	38	45	24	25	14	20	1.48	1.56	3.68	2.71	28.1	27.6	27.2	26.4	27.0	26.6	26.6	26.2
			C	SiL	SiCL	ML	CH	10	9	66	63	24	28	99.4	99.8	38	53	25	26	13	27	1.45	1.48	2.68	2.71	29.4	29.1	28.7	28.3	28.3	28.4	27.7	28.0
			D	SiL	SiCL	ML	CL	11	8	76	64	13	28	99.0	99.6	36	48	26	24	10	24	1.41	1.46	2.66	2.71	31.2	29.2	30.4	28.6	29.7	28.6	28.8	28.2
		2	A	SiL	SiL	ML	CL	12	10	74	68	14	22	98.8	99.2	32	38	26	24	6	14	1.44	1.41	2.66	2.69	29.5	30.6	28.4	29.0	27.9	28.5	27.7	28.0
			B	SiL	SiL	ML	ML	13	12	73	64	14	14	99.4	99.0	32	28	26	23	6	5	1.46	1.44	2.66	2.66	28.4	29.6	27.2	28.3	26.7	27.4	26.4	26.8
			C	SiL	SiL	ML	ML	11	10	77	77	12	13	99.4	99.4	34	27	27	26	7	1	1.39	1.36	2.66	2.66	32.2	31.1	30.7	29.2	30.1	28.3	29.6	27.8
			D	Si	SiL	ML	ML	9	9	81	78	10	13	98.6	99.6	34	29	27	24	7	5	1.39	1.42	2.66	2.66	32.2	30.8	30.6	29.2	30.1	28.5	29.4	27.8
		3	A	SiL	SiL	ML	CL	11	10	74	71	15	19	98.8	99.0	31	32	28	23	3	9	1.42	1.44	2.67	2.69	32.2	30.2	31.0	29.0	30.4	28.5	29.6	27.7
			B	SiL	SiL	ML	CL	12	9	76	68	12	23	98.6	99.8	31	42	24	25	7	17	1.40	1.44	2.65	2.71	32.4	30.2	30.8	29.2	30.2	28.8	29.2	28.1
			C	SiL	SiL	ML	CL	12	9	76	70	12	21	99.2	99.8	32	43	25	26	7	17	1.42	1.48	2.65	2.70	31.6	29.3	30.2	28.3	29.6	28.0	29.2	27.7
			D	SiL	SiL	ML	CL	11	9	72	67	17	24	99.2	99.4	36	44	27	24	9	20	1.42	1.41	2.65	2.71	31.3	31.1	30.2	30.1	29.5	29.6	29.1	35.0
		4	A	SiCL	SiL	CL	CH	8	9	60	64	32	27	99.8	99.8	43	51	25	26	18	25	1.48	1.53	2.69	2.71	28.0	27.8	27.4	26.8	27.0	26.8	26.7	26.4
			B	SiCL	SiL	CL	CL	8	9	64	64	28	27	99.8	99.8	42	48	24	27	18	21	1.48	1.52	2.68	2.71	28.2	27.6	27.6	26.8	27.5	27.0	27.0	26.6
			C	SiCL	SiL	CL	CH	8	8	64	66	28	26	99.8	99.8	39	52	24	26	15	26	1.47	1.52	2.68	2.71	28.7	28.2	27.6	27.3	27.6	27.6	27.2	27.2
			D	SiL	SiL	ML	ML	9	9	68	68	23	23	98.4	99.8	41	43	26	26	15	17	1.42	1.54	2.68	2.71	31.0	27.5	30.2	26.7	29.9	26.6	29.3	26.2
		5	A	SiL	SiL	ML	ML	10	9	70	72	20	19	99.2	99.8	40	43	26	28	14	15	1.48	1.52	2.68	2.68	28.8	28.0	27.7	27.2	27.3	27.0	27.3	26.8
			B	SiL	SiL	CL	CL	10	8	68	67	22	25	99.8	99.8	40	44	24	24	16	20	1.48	1.54	2.68	2.71	28.5	28.0	27.7	26.8	27.4	26.8	27.0	26.7
			C	SiL	SiL	CL	CL	10	8	70	69	20	23	99.4	99.8	39	45	25	26	14	19	1.46	1.54	2.68**	2.71**	29.2	27.4	28.2	26.6	28.0	26.3	27.8	26.1
			D	SiL	SiL	ML	ML	9	9	68	68	23	23	99.8	99.8	40	42	27	26	13	16	1.48	1.54	2.68	2.70	28.8	28.0	27.7	27.2	27.4	26.8	27.2	26.7
L I	L2	1	A	SiL	SiCL	CL	CH	12	8	72	61	16	31	99.2	99.8	50	52	23	22	27	30	1.51	1.53	2.65	2.71	31.0	28.8	29.4	27.0	29.1	26.6	28.8	26.6
			B	SiL	SiCL	ML	CL	11	8	69	62	20	30	99.6	99.8	35	45	28	25	7	20	1.44	1.56	2.68	2.70	32.2	27.0	31.3	26.0	30.3	25.9	30.1	25.8
			C	SiL	SiCL	ML	CL	9	8	68	63	23	29	99.8	99.8	31	48	26	23	5	25	1.44	1.55	2.68	2.71	31.8	26.1	30.2	25.2	29.8	25.2	29.6	25.4
			D	SiCL	SiCL	ML	CL	8	9	62	61	30	30	99.8	99.8	35	46	27	24	8	22	1.44	1.56	2.69	2.71	31.5	25.8	30.1	25.2	29.5	25.4	29.3	25.5
		2	A	SiL	SiL	ML	CL	12	10	80	70	8	20	99.2	99.8	36	40	29	23	7	17	1.34	1.52	2.64	2.69	35.7	28.1	33.6	26.9	33.0	26.5	32.6	26.4
			B	SiL	SiCL	ML	CL	14	8	77	62	9	30	99.4	99.8	34	45	27	22	7	23	1.45	1.54	2.64	2.71	32.4	27.4	31.0	26.4	30.3	26.5	30.0	25.8
			C	SiL	SiL	ML	CL	13	9	79	64	8	27	99.4	99.8	35	47	27	24	8	23	1.48	1.56	2.64	2.70	30.0	26.4	28.3	25.2	27.8	25.3	27.6	25.4
			D	SiL	SiCL	ML	CL	9	9	72	62	19	29	99.8	99.8	36	43	27	24	9	19	1.44	1.56	2.68	2.70	31.6	26.6	30.0	25.7	29.7	25.8	29.4	25.7

(Continued)

** Estimated.

Table A2 (Continued)

				Classification				Grain-Size Analysis, %										Atterberg Limits						Dry Density g/cc		Specific Gravity		Soil Moisture, %, at							
				USDA		USCS		USDA						USCS																					
								Sand		Silt		Clay		Fines		IL		PL		PI						Saturation		0.015-atm Tension		0.03-atm Tension		0.06-atm Tension	
Site	Plot	Row	Position	0-6	6-12	0-6	6-10	0-6	6-12	0-6	6-12	0-6	6-12	0-6	6-12	0-6	6-12	0-6	6-12	0-6	6-12	0-6	6-12	0-6	6-12	0-6	6-12	0-6	6-12	0-6	6-12	0-6	6-12
															Loring Soil Series (Continued)																		
L I	12	3	A	SiL	SiCL	CL	CH	14	9	77	62	9	29	98.6	99.8	37	53	23	26	14	27	1.46	1.56	2.64	2.71	29.4	26.2	28.2	25.6	27.6	25.6	27.4	25.4
			B	SiCL	SiCL	CL	CH	8	9	59	61	33	30	99.8	99.8	48	54	23	24	25	30	1.50	1.54	2.69	2.71	29.2	27.4	27.5	26.6	27.2	26.5	26.8	26.3
			C	SiL	SiCL	ML	CL	10	9	67	63	23	28	99.6	99.8	34	47	26	24	8	23	1.50	1.54	2.68	2.71	28.0	27.4	26.9	26.4	26.4	26.6	26.2	26.8
			D	SiL	SiCL	ML	CH	9	9	69	61	22	30	99.8	99.8	36	54	26	21	10	33	1.44	1.52	2.65	2.70	30.5	27.4	29.0	26.7	28.8	27.0	28.6	27.2
		4	A	SiL	SiL	CL	CH	12	12	70	69	18	19	98.6	99.0	48	54	23	26	28	28	1.46	1.55	2.65	2.69	29.3	26.3	28.5	25.4	28.2	25.6	27.8	25.2
			B	SiCL	SiCL	CL	CH	11	9	59	63	30	28	99.6	99.8	41	51	24	25	17	26	1.46	1.54	2.68	2.70	29.6	27.8	28.6	26.8	28.2	26.8	27.9	26.6
			C	SiCL	SiCL	CL	CH	10	10	62	60	28	30	99.8	99.8	42	54	23	26	19	28	1.52	1.54	2.67	2.70	27.6	27.2	26.4	26.2	25.9	26.2	25.6	26.1
			D	SiL	SiL	ML	ML	12	12	75	74	13	14	99.4	99.8	31	31	26	[illegible]	5	8	1.52	1.50	2.66	2.69	26.8	28.9	25.8	27.4	25.4	26.7	25.0	26.2
		5	A	SiCL	SiCL	CL	CH	9	9	61	63	30	28	99.8	99.8	42	51	24	27	18	24	1.52	1.52	2.66	2.71	27.2	27.0	26.1	26.3	25.8	26.4	25.6	26.2
			B	SiL	SiCL	CL	CL	12	8	74	62	14	30	99.2	99.8	46	49	26	26	20	23	1.46	1.51	2.64**	2.71**	30.8	29.2	29.0	28.6	28.4	28.4	28.0	28.2
			C	SiL	SiCL	ML	CH	9	10	64	60	27	30	99.6	99.8	38	58	25	24	13	34	1.46	1.48	2.63	2.70	30.3	28.8	29.2	[illegible]	28.8	28.0	28.5	27.8
			D	SiL	SiL	ML	ML	17	9	71	74	12	17	99.6	99.8	34	33	24	25	10	8	1.44	1.42	2.64	2.69	30.2	30.7	29.0	29.7	28.5	29.0	28.0	28.6
L [illegible]	13	[illegible]	A	SiCL	SiCL	CL	CH	9	10	59	60	32	30	99.8	99.8	46	52	25	[illegible]	21	26	1.42	1.45	2.69	2.71	31.0	30.8	30.4	30.1	29.8	29.8	29.5	29.8
			B	SiCL	[illegible]	CL	CH	9	8	55	57	37	35	99.6	99.8	36	50	24	28	12	22	1.46	1.44	[illegible]	2.71**	28.8	31.8	28.2	31.2	27.5	30.6	27.2	30.4
			C	SiL	SiCL	[illegible]	CH	[illegible]	8	64	63	27	29	99.6	99.8	42	54	26	26	16	28	1.42	1.47	2.68	2.70	29.8	29.9	29.2	[illegible]	28.6	29.0	28.4	29.0
			D	SiL	SiCL	CL	CH	10	8	66	60	24	32	99.6	99.8	38	55	24	25	14	30	1.46	1.48	2.68	[illegible]	29.8	30.3	29.0	29.7	28.4	29.2	28.2	29.2
		2	A	SiL	SiCL	CL	CH	11	10	66	59	23	31	99.8	99.8	36	50	24	26	12	24	1.42	1.44	2.68	2.70	30.0	31.5	29.4	30.8	28.6	30.2	28.4	30.2
			B	SiL	SiCL	ML	CL	11	8	66	60	23	32	99.8	99.8	37	48	25	25	12	23	1.42	1.42	2.68	2.70	32.4	31.6	31.6	31.1	30.8	30.6	30.4	30.4
			C	SiL	SiCL	CL	CL	10	9	72	61	18	30	99.6	99.8	34	48	23	25	11	23	1.40	1.44	2.67	2.71	32.0	30.2	30.8	29.4	30.3	28.9	29.9	28.3
			D	SiL	SiCL	ML	CL	12	9	73	63	15	28	99.6	99.8	35	39	27	23	8	16	1.42	1.46	2.66	2.70	30.7	30.0	29.8	29.4	28.8	28.7	28.4	28.4
		3	A	SiL	SiL	ML	CL	11	10	72	66	17	24	99.4	99.8	37	47	26	24	11	23	1.44	1.41	2.66	2.70	30.5	32.0	29.0	30.8	28.6	30.1	28.2	29.6
			B	SiL	SiL	ML	CL	10	9	70	64	20	27	99.6	99.8	40	44	26	24	14	20	1.46	1.44	2.66	2.70	30.2	31.2	28.8	30.0	28.4	29.6	28.1	29.3
			C	SiL	SiL	ML	CL	10	10	66	66	24	24	99.6	99.8	38	44	25	25	13	19	1.44	1.45	2.68	2.69	29.2	30.5	28.0	30.0	27.6	29.5	27.2	29.4
			D	SiCL	SiCL	CL	ML	9	9	62	63	29	28	99.6	99.8	44	44	24	27	20	17	1.42	1.40	2.68	2.70	[illegible]	32.6	29.8	32.0	29.4	31.6	29.4	31.4
		4	A	SiL	SiL	ML	ML	10	9	73	71	17	20	99.8	99.4	34	36	24	25	10	11	1.44	1.44	2.66	2.70	30.2	31.2	29.0	29.8	28.2	29.2	27.8	28.6
			B	SiL	SiL	ML	CL	10	9	67	64	23	27	99.8	99.6	37	46	25	25	12	21	1.42	1.48	2.67	2.71	31.4	30.3	29.8	29.0	29.0	28.6	28.6	28.2
			C	SiL	SiCL	ML	CL	13	9	75	63	12	28	99.8	99.8	34	44	27	25	7	19	1.46	1.47	2.64	2.69	28.9	30.0	27.6	28.8	27.0	28.5	26.6	28.2
			D	SiL	SiL	CL	CL	11	10	62	66	27	24	99.8	99.8	41	46	23	26	18	20	1.54	1.53	2.66	2.69	26.0	27.4	24.8	26.3	24.0	26.1	23.8	25.9
		5	A	SiL	SiL	ML	CH	13	10	77	73	10	17	99.6	99.8	36	50	26	27	10	23	1.42	1.42	2.64	2.71	32.0	30.8	30.7	30.2	29.9	30.2	29.6	29.8
			B	SiL	SiCL	ML	CH	10	10	77	60	13	30	99.8	100.0	40	54	30	26	10	28	1.42	1.53	2.65	2.71	32.6	27.4	30.8	26.4	30.2	26.2	29.6	25.9
			C	SiL	SiCL	ML	CL	12	9	76	61	12	30	99.6	99.8	32	42	24	22	8	20	1.50	1.51	2.64	2.71	28.8	27.2	28.2	26.8	27.7	26.8	27.2	26.4
			D	SiCL	SiCL	ML	CH	8	9	62	61	30	30	99.8	99.8	35	52	24	24	11	28	1.50	1.47	2.69	2.71	29.0	30.1	27.6	29.1	27.1	28.8	26.6	28.6
L IV	14	1	A	SiL	SiCL	ML	CL	12	8	76	64	12	28	98.8	99.8	32	46	24	25	8	21	1.45	1.52	2.65**	2.69**	29.4	26.8	28.0	26.0	27.6	26.0	27.2	25.7
			B	SiL	SiL	ML	CL	13	8	74	65	13	27	98.8	99.8	33	48	24	24	9	24	1.49	1.50	2.65	2.69	28.6	28.0	27.1	26.8	26.9	27.0	26.5	26.2
			C	SiL	SiL	ML	CL	12	9	75	67	13	24	99.2	99.8	34	45	24	25	10	20	1.47	1.54	2.65	2.69	29.2	27.6	27.6	26.5	27.4	26.5	26.8	25.2
			D	SiL	SiL	CL	CL	9	9	64	64	27	27	99.6	99.8	39	48	24	26	15	22	1.51	1.55	2.68	2.70	26.4	26.3	25.4	25.2	25.6	25.4	25.2	24.6
		2	A	SiL	SiL	ML	CL	10	9	56	65	24	26	99.2	99.8	33	47	25	25	8	22	1.54	1.54	2.68	2.69	27.3	27.8	25.6	27.0	25.0	27.0	25.0	26.9
			B	SiL	SiL	ML	CL	13	11	72	67	15	22	98.6	99.6	32	39	24	23	8	16	1.51	1.52	2.66	2.68	27.1	27.2	26.0	26.2	25.0	26.2	25.0	26.0
			C	SiL	SiL	CL	CH	9	9	66	65	25	26	99.6	99.6	38	50	23	25	15	25	1.50	1.54	2.68	2.69	27.0	27.6	26.0	26.4	25.6	26.2	25.4	26.0
			D	SiL	SiL	ML	CL	13	13	74	70	12	17	98.8	99.8	33	32	25	23	8	9	1.49	1.50	2.64	2.65	27.2	28.0	26.2	26.9	26.2	26.8	25.8	25.6

(Continued)

** Estimated.

Table A2 (Continued)

Site	Plot	Row	Position	Classification USDA 0-6	Classification USDA 6-12	Classification USCS 0-6	Classification USCS 6-12	Grain-Size Analysis, % USDA Sand 0-6	Sand 6-12	Silt 0-6	Silt 6-12	Clay 0-6	Clay 6-12	USCS Fines 0-6	Fines 6-12	Atterberg Limits LL 0-6	LL 6-12	PL 0-6	PL 6-12	PI 0-6	PI 6-12	Dry Density g/cc 0-6	Dry Density 6-12	Specific Gravity 0-6	Specific Gravity 6-12	Soil Moisture, %, at Saturation 0-6	Saturation 6-12	0.015-atm Tension 0-6	0.015-atm Tension 6-12	0.03-atm Tension 0-6	0.03-atm Tension 6-12	0.06-atm Tension 0-6	0.06-atm Tension 6-12
															Loring Soil Series (Continued)																		
L IV	14	3	A	SiL	SiL	ML	CL	13	11	75	72	12	17	99.4	99.8	29	38	25	24	4	14	1.46	1.53	2.64	2.66	29.6	26.8	27.8	25.3	26.7	24.5	26.6	24.4
			B	SiL	SiL	ML	ML	11	12	76	72	13	16	99.6	99.8	31	31	25	24	6	7	1.46	1.50	2.64	2.66	28.2	26.6	26.3	25.0	25.0	24.3	24.9	24.2
			C	SiL	SiL	ML	CL	13	11	73	71	14	18	99.0	99.8	28	33	27	22	1	11	1.42	1.52	2.64	2.66	30.7	26.9	28.7	25.1	26.9	24.2	26.8	24.0
			D	SiL	SiL	ML	CL	12	12	74	75	14	13	99.4	99.8	32	32	27	33	5	9	1.47	1.47	2.64	2.65	27.8	29.0	26.4	27.4	25.4	26.4	25.4	26.4
		4	A	SiL	SiL	ML	CL	12	12	78	72	10	16	99.2	99.4	32	31	26	22	6	9	1.40	1.48	2.64	2.66	30.8	28.7	30.9	27.2	30.4	26.6	29.8	26.0
			B	SiL	SiL	ML	ML	13	11	76	75	11	14	99.4	99.8	36	30	28	23	8	7	1.41	1.51	2.64	2.66	32.3	27.9	30.2	26.0	28.2	24.8	28.4	24.6
			C	SiL	SiL	ML	CL	14	11	76	75	10	14	99.6	99.8	30	30	26	22	4	8	1.42	1.50	2.64	2.66	30.9	28.7	29.0	26.6	28.0	25.6	28.0	25.3
			D	SiL	SiL	ML	ML	14	11	78	73	8	16	98.8	99.6	30	29	25	23	5	6	1.40	1.50	2.64	2.66	32.6	27.9	30.1	26.0	28.4	25.0	28.4	24.8
		5	A	SiL	SiL	ML	ML	14	11	76	75	10	14	99.0	99.4	30	35	26	24	4	11	1.52	1.48	2.64	2.68	26.5	29.4	25.1	27.8	24.8	27.4	24.4	26.8
			B	SiL	SiL	ML	CL	14	12	76	76	10	12	98.4	99.6	30	32	25	23	5	9	1.48	1.48	2.64	2.68	28.2	29.9	26.6	27.6	26.5	27.0	25.9	25.6
			C	SiL	SiL	ML	CL	14	12	75	75	11	13	99.6	99.6	33	31	28	22	5	9	1.50	1.48	2.64	2.68	28.8	30.5	26.6	27.8	26.0	27.0	25.6	26.4
			D	SiL	SiL	ML	ML	14	14	76	76	10	10	99.8	99.0	32	27	26	25	6	2	1.47	1.46	2.64	2.65	28.9	30.1	27.0	27.9	26.8	27.5	26.2	26.8
L III	15	1	A	SiL	SiCL	CL	CH	14	1	64	59	22	40	97.6	99.8	38	53	20	25	18	28	1.49	1.45	2.65	2.72	27.8	30.7	26.6	29.5	26.4	29.4	26.4	29.3
			B	SiCL	SiCL	CL	CH	4	9	67	59	29	32	99.8	99.8	38	56	23	23	15	33	1.46	1.54	2.69	2.71	29.9	28.5	28.0	27.2	27.6	27.2	27.2	26.9
			C	SiL	SiCL	CL	CL	6	9	67	59	27	32	98.8	99.8	37	41	24	23	13	18	1.56	1.55	2.69	2.71	25.1	26.6	24.2	25.8	24.2	25.8	24.2	25.6
			D	SiL	SiCL	CL	CH	7	2	71	60	22	30	98.8	99.8	46	50	25	23	21	27	1.50	1.53	2.68	2.72	28.8	26.2	26.7	25.0	26.4	25.5	26.0	25.0
		2	A	SiL	SiL	ML	ML	7	14	80	74	13	12	99.2	99.4	32	27	26	22	6	5	1.39	1.52	2.66	2.65	31.7	27.2	30.0	25.3	29.6	24.8	29.0	24.4
			B	SiL	SiL	ML	ML	15	8	73	78	12	14	99.4	99.2	35	28	25	23	10	5	1.40	1.46	2.64	2.66	30.6	28.0	28.6	26.4	28.3	26.0	28.0	25.6
			C	SiL	SiL	ML	CL	8	14	79	73	13	13	97.8	99.6	29	30	24	21	5	9	1.50	1.52	2.66	2.65	26.8	26.2	25.0	24.6	24.6	24.2	24.2	24.0
			D	SiL	SiL	ML	[illegible]	6	5	77	77	17	18	99.2	99.6	35	33	29	23	6	10	1.43	1.49	2.67	2.70	29.4	27.2	27.8	25.8	27.4	25.4	27.0	25.0
		3	A	SiL	SiL	ML	ML	14	10	76	77	10	13	99.0	99.0	34	29	29	25	5	4	1.44	1.44	2.64	2.65	28.4	31.9	27.2	28.5	26.8	27.6	26.4	27.1
			B	SiL	SiL	ML	CL	14	13	74	75	12	12	98.6	98.8	30	29	24	21	6	8	1.48	1.48	2.64	2.65	28.5	28.9	27.0	26.5	26.6	25.9	26.4	25.5
			C	SiL	SiL	ML	ML	7	6	78	80	15	14	98.2	98.8	34	28	29	22	5	6	1.44	1.54	2.66	2.67	30.2	25.6	28.6	24.2	28.2	24.0	27.8	23.7
			D	SiL	SiL	ML	ML	6	4	80	79	14	17	98.8	99.2	28	29	26	22	2	7	1.46	1.58	2.66	2.67	28.6	24.8	26.8	23.4	26.3	23.1	25.9	22.8
		4	A	SiL	SiL	ML	ML	6	12	79	75	15	13	97.2	98.4	33	29	27	23	6	6	1.41	1.43	2.66	2.66	31.6	31.2	29.6	29.0	29.2	28.6	28.8	28.0
			B	SiL	SiL	ML	ML	14	7	74	77	12	16	98.0	97.0	35	29	29	24	6	5	1.37	1.48	2.64	2.70	34.4	29.4	32.2	27.1	31.8	26.6	31.4	26.2
			C	SiL	SiL	ML	CL	7	14	80	73	13	13	97.4	97.8	34	28	27	21	7	7	1.45	1.48	2.66**	2.65**	28.6	28.4	27.2	26.8	26.8	26.3	26.6	25.8
			D	SiL	SiL	ML	CL	7	12	80	75	13	13	97.4	98.0	32	29	25	22	7	7	1.40	1.46	2.66	2.65	31.6	32.0	29.6	28.8	29.1	27.8	28.8	27.4
		5	A	SiL	SiL	ML	ML	13	11	76	77	11	12	97.4	98.0	33	31	25	25	8	6	1.42	1.46	2.64	2.65	31.0	29.8	28.5	27.6	28.4	27.2	27.9	27.0
			B	SiL	SiL	ML	ML	12	12	77	76	11	12	97.6	98.4	33	30	27	24	6	6	1.48	1.44	2.64	2.65	28.4	30.0	26.8	28.0	26.6	27.6	26.2	27.2
			C	SiL	SiL	ML	ML	12	3	77	80	11	17	98.0	98.4	31	30	26	23	5	7	1.46	1.48	2.65	2.69	28.8	28.0	27.2	26.4	26.9	26.2	26.6	25.7
			D	Si	SiL	ML	CL	15	11	81	75	14	14	97.6	99.0	30	31	27	22	3	9	1.45	1.50	2.66	2.68	29.2	27.5	28.0	26.0	28.0	25.9	27.6	25.5
															Henry Soil Series																		
M VI	HM1	1	A	SiL	SiL	ML	ML	8	15	74	65	18	20	97.6	91.2	34	41	24	26	10	15	1.46	1.38	2.68	2.70	28.9	34.1	28.0	33.0	27.8	32.6	27.4	32.2
			B	SiL	SiL	ML	ML	10	10	76	70	14	20	96.8	96.0	35	43	25	27	10	16	1.50	1.38	2.68	2.70	28.1	33.2	27.5	32.3	27.2	31.8	26.8	31.2
			C	SiL	SiL	CL	CL	9	12	76	68	15	20	95.6	94.4	35	39	24	24	11	14	1.40	1.34	2.68	2.69	32.7	37.1	31.4	35.5	31.2	35.2	30.8	34.6
			D	SiL	SiL	ML	ML	10	13	70	67	20	20	96.6	94.6	34	41	24	26	10	15	1.47	1.35	2.68	2.69	29.2	36.1	28.0	34.6	27.8	34.3	27.4	33.6
		2	A	SiL	SiL	ML	CL	16	20	75	65	9	15	91.4	37.0	33	28	28	21	5	7	1.42	1.48	2.66	2.70	32.2	28.2	30.6	26.8	30.2	[illegible]	29.8	25.8
			B	SiL	SiL	ML	CL	15	15	73	67	12	18	91.8	92.0	31	27	26	21	5	6	1.42	1.52	2.67	2.70	32.2	25.8	30.8	24.6	30.4	23.8	29.8	23.4
			C	SiL	SiL	ML	ML	15	15	75	67	10	18	92.3	92.6	35	27	28	22	7	5	1.37	1.48	2.67	2.70	34.4	26.8	32.6	25.6	32.2	25.0	31.6	24.7
			D	SiL	SiL	ML	ML	15	15	73	71	12	14	93.4	92.0	37	27	25	22	12	5	1.37	1.45	2.67	2.69	33.0	29.8	31.6	28.0	31.4	27.3	30.8	26.6

(Continued)

** Estimated.

Table A2 (Continued)

Site	Plot	Row	Position	Classification USDA 0-6	Classification USDA 6-12	Classification USCS 0-6	Classification USCS 6-12	Grain-Size Analysis, % USDA Sand 0-6	Sand 6-12	Silt 0-6	Silt 6-12	Clay 0-6	Clay 6-12	USCS Fines 0-6	Fines 6-12	Atterberg Limits LL 0-6	LL 6-12	PL 0-6	PL 6-12	PI 0-6	PI 6-12	Dry Density g/cc 0-6	Dry Density 6-12	Specific Gravity 0-6	Specific Gravity 6-12	Soil Moisture, %, at Saturation 0-6	Saturation 6-12	0.05-atm Tension 0-6	0.05-atm Tension 6-12	0.03 atm Tension 0-6	0.03 atm Tension 6-12	0.06-atm Tension 0-6	0.06-atm Tension 6-12
																Collins Soil Series																	
C III	C1	1	A	SiL	SiL	ML	ML	11	8	80	81	9	11	99.6	99.8	40	34	28	27	12	7	1.44	1.38	2.66	2.67	30.6	32.4	29.4	31.2	29.5	30.5	28.9	29.4
			B	SiL	SiL	ML	ML	11	9	78	81	11	10	99.6	99.8	35	33	27	25	8	8	1.44	1.44	2.67	2.68	30.0	31.4	29.2	30.0	28.8	30.0	28.2	29.2
			C	SiL	SiL	ML	ML	11	9	79	80	10	11	99.8	99.6	37	34	28	28	9	6	1.44	1.44	2.67	2.68	30.2	32.2	29.5	30.8	29.0	30.0	28.4	28.8
			D	SiL	SiL	ML	ML	9	9	81	81	10	10	99.8	99.8	34	34	25	27	9	7	1.43	1.43	2.66	2.67	30.6	32.4	29.6	30.8	29.2	30.2	28.2	29.0
		2	A	SiL	SiL	ML	ML	12	12	80	78	8	10	99.0	99.6	38	32	29	25	10	6	1.42	1.42	2.66	2.67	31.6	34.2	30.7	32.2	29.8	31.1	29.1	30.2
			B	SiL	SiL	ML	ML	11	13	80	77	9	10	99.2	99.2	36	32	29	26	7	6	1.41	1.43	2.67	2.67	32.2	32.6	30.9	31.0	30.2	30.2	29.2	29.0
			C	SiL	SiL	ML	ML	13	12	77	78	10	10	99.0	99.6	37	33	29	24	8	9	1.43	1.42	2.67	2.68	30.6	32.2	29.7	31.0	29.2	30.0	28.6	29.0
			D	SiL	SiL	ML	ML	12	13	78	77	10	10	99.2	99.2	39	30	31	25	8	5	1.38	1.40	2.65	2.67	32.7	32.2	31.8	31.3	31.3	30.4	30.4	29.4
		3	A	SiL	SiL	ML	ML	15	15	76	75	9	10	98.0	97.2	34	31	28	26	[illegible]	[illegible]	1.33	1.40	2.66	2.67	35.8	33.2	34.2	31.6	33.1	30.3	31.9	29.0
			B	SiL	SiL	ML	ML	15	15	75	75	10	10	97.8	97.0	37	28	31	26	6	2	1.39	1.38	2.66	2.67	37.2	34.8	35.6	32.6	34.6	31.4	33.1	29.3
			C	SiL	SiL	ML	ML	15	17	76	75	9	8	98.0	95.2	34	29	26	25	8	4	1.34	1.39	2.66	2.67	34.6	33.0	33.7	31.0	33.0	29.8	31.6	28.6
			D	SiL	SiL	ML	ML	15	15	77	75	8	10	97.8	96.4	32	30	27	26	5	4	1.33	1.42	2.65	2.66	36.6	33.2	34.8	31.1	33.8	30.0	32.4	28.6
		4	A	SiL	SiL	ML	ML	20	24	72	68	8	8	94.4	89.6	34	29	27	23	7	6	1.37	1.49	2.66	2.67	34.4	27.9	33.1	26.9	32.3	26.1	31.3	25.0
			B	SiL	SiL	ML	ML	25	25	68	66	7	9	89.6	86.8	31	28	25	24	6	4	1.40	1.47	2.65	2.66	33.4	32.1	30.8	32.0	30.0	30.0	28.8	29.0
			C	SiL	SiL	ML	ML	25	20	67	70	8	10	88.8	94.0	33	29	28	26	5	3	1.41	1.43	2.65	2.66	31.3	32.0	30.1	30.2	29.4	29.2	28.6	28.0
			D	SiL	SiL	ML	ML	25	20	67	71	8	9	88.0	93.8	29	30	26	24	3	6	1.36	1.44	2.65	2.66	33.8	30.4	32.2	29.3	31.0	28.4	30.8	27.1
		5	A	SiL	SiL	ML	ML	15	19	77	71	8	10	96.4	93.6	30	27	28	22	2	5	1.40	1.42	2.66	2.67	30.3	32.2	29.8	30.6	29.4	29.6	28.1	28.3
			B	SiL	SiL	ML	CL	20	20	70	69	10	11	93.8	94.2	33	29	27	22	6	7	1.30	1.43	2.66	2.67	37.0	33.0	34.6	30.8	34.0	29.8	32.8	28.4
			C	SiL	SiL	ML	ML	18	20	73	70	9	10	96.4	94.6	34	29	29	25	5	4	1.37	1.43	2.65	2.66	32.8	32.0	31.6	30.4	31.0	29.5	30.1	28.4
			D	SiL	SiL	ML	ML	23	20	69	70	8	10	96.6	92.4	35	30	27	24	8	6	1.34	1.44	2.65	2.66	34.5	32.7	33.2	30.6	32.6	29.6	31.4	28.4
C I	C2	2	A	SiL	SiL	ML	ML	14	16	76	74	10	10	99.0	99.4	34	31	27	27	7	4	1.47	1.41	2.67	2.67	30.0	34.2	28.6	32.0	28.4	31.4	28.3	30.9
			B	SiL	SiL	ML	ML	15	15	75	74	10	11	99.6	99.2	32	32	26	26	6	6	1.44	1.42	2.67	2.67	32.2	33.8	30.8	31.6	30.5	31.1	30.4	30.8
			C	SiL	SiL	ML	ML	15	15	75	75	10	10	99.6	99.2	34	33	27	27	7	6	1.43	1.46	2.67	2.67	32.0	32.4	30.2	30.2	30.0	29.8	29.7	29.5
			D	SiL	SiL	ML	ML	15	15	75	75	10	10	99.6	99.6	33	31	26	25	7	6	1.46	1.43	2.67	2.67	30.0	32.8	29.0	30.9	28.8	30.2	28.6	29.3
		3	A	SiL	SiL	ML	ML	15	15	76	75	9	10	99.6	99.6	33	33	28	24	5	9	1.46	1.46	2.67	2.67	31.3	32.0	30.2	30.2	29.7	29.8	29.0	29.0
			B	SiL	SiL	ML	ML	17	16	74	75	9	9	99.6	99.6	31	31	26	26	5	5	1.48	1.44	2.67	2.67	30.2	31.4	29.1	30.0	28.8	29.6	28.6	28.8
			C	SiL	SiL	ML	ML	16	16	75	75	9	9	99.6	99.4	33	31	24	27	9	4	1.46	1.45	2.67	2.67	31.8	31.4	30.0	29.4	29.6	29.0	29.2	28.6
			D	SiL	SiL	ML	ML	16	15	75	75	9	10	99.4	99.6	33	31	27	24	6	7	1.45	1.44	2.67	2.67	31.5	32.6	29.8	30.4	29.4	30.0	29.0	29.6
		4	A	SiL	SiL	ML	ML	15	15	75	76	10	9	99.8	99.8	35	33	28	27	7	6	1.44	1.44	2.67	2.67	32.2	32.3	30.4	30.2	30.1	29.8	29.6	29.5
			B	SiL	SiL	ML	ML	14	15	77	76	9	9	99.6	99.8	33	31	27	26	6	5	1.48	1.44	2.67	2.67	30.0	32.2	29.0	30.6	28.7	30.2	28.3	29.6
			C	SiL	SiL	ML	ML	15	15	75	75	10	10	99.8	99.6	34	32	27	26	7	6	1.40	1.46	2.67	2.67	33.0	31.4	32.0	29.9	31.7	29.6	31.2	28.9
			D	SiL	SiL	ML	ML	16	15	75	76	9	9	99.6	99.6	32	31	26	27	6	4	1.46	1.45	2.67	2.67	31.0	30.8	29.2	29.2	29.2	28.8	28.8	28.4
F II	C3	1	A	SiL	SiL	ML	ML	12	14	75	72	13	14	99.2	98.4	35	31	26	26	9	5	1.33	1.42	2.66	2.67**	34.7	30.6	33.0	29.8	32.2	29.1	31.4	28.2
			B	SiL	SiL	ML	ML	12	14	75	75	13	11	99.6	99.6	36	35	27	28	9	7	1.32	1.44	2.67	2.66	34.3	30.1	32.8	29.0	32.0	28.4	31.2	27.9
			C	SiL	SiL	ML	ML	12	12	76	76	12	12	99.4	99.8	36	32	27	25	9	7	1.35	1.42	2.67	2.67	33.4	31.2	32.6	30.5	31.8	29.9	31.1	29.0
			D	SiL	SiL	ML	ML	11	11	75	75	14	14	99.8	99.8	36	33	27	27	9	6	1.27	1.44	2.66	2.67	38.1	29.6	36.6	29.0	35.7	28.4	34.6	27.9
		3	A	SiL	SiL	ML	ML	12	12	77	75	11	13	99.4	99.4	33	31	24	23	9	8	1.34	1.44	2.67	2.66	33.6	30.6	32.0	29.4	31.6	29.2	30.2	28.0
			B	SiL	SiL	ML	ML	12	12	76	74	12	14	99.2	99.4	35	32	27	28	8	4	1.39	1.45	2.66	2.66	31.6	29.9	30.5	28.8	30.2	28.6	28.2	27.0
			C	SiL	SiL	ML	ML	12	12	74	76	14	12	99.4	99.4	36	31	26	23	10	9	1.34	1.44	2.68**	2.69	34.6	31.2	32.9	29.9	32.2	29.4	31.6	28.9
			D	SiL	SiL	ML	ML	12	12	76	76	12	12	99.2	99.4	33	31	26	26	7	5	1.43	1.43	2.65	2.66	29.7	31.2	29.1	30.1	28.6	29.5	28.3	28.9

(Continued)

** Estimated.

Table A2 (Continued)

Site	Plot	Row	Position	Classification USDA 0-6	Classification USDA 6-12	Classification USCS 0-6	Classification USCS 6-12	Grain-Size Analysis, % USDA Sand 0-6	Sand 6-12	Silt 0-6	Silt 6-12	Clay 0-6	Clay 6-12	USCS Fines 0-6	USCS Fines 6-12	Atterberg Limits LL 0-6	LL 6-12	PL 0-6	PL 6-12	PI 0-6	PI 6-12	Dry Density g/cc 0-6	Dry Density 6-12	Specific Gravity 0-6	Specific Gravity 6-12	Soil Moisture, %, at Saturation 0-6	Saturation 6-12	0.015-atm Tension 0-6	0.015-atm Tension 6-12	0.05-atm Tension 0-6	0.05-atm Tension 6-12	0.06-atm Tension 0-6	0.06-atm Tension 6-12
Palaya Soil Series																																	
F VII	F1	1	A	SiL	SiL	ML	ML	14	14	75	73	11	13	99.0	99.6	33	32	26	27	7	5	1.46	1.46	2.63	2.69	28.4	30.6	27.8	29.3	26.0	28.2	26.7	27.9
			B	SiL	SiL	ML	ML	16	12	72	74	12	14	99.0	99.8	31	32	26	24	5	8	1.42	1.46	2.63	2.65	29.6	30.5	28.6	29.4	27.5	28.3	27.2	27.8
			C	SiL	SiL	ML	ML	15	9	73	79	12	12	99.2	99.8	32	32	27	25	5	7	1.42	1.42	2.64	2.66	30.2	30.2	29.2	29.3	28.0	28.4	27.8	28.2
			D	SiL	SiL	ML	ML	15	10	74	78	11	12	99.0	99.8	31	31	25	27	6	4	1.50	1.46	2.63	2.65	28.1	29.9	27.0	28.9	26.1	27.8	25.5	27.5
		2	A	SiL	SiL	ML	ML	12	15	75	75	13	10	99.2	99.8	33	31	25	26	8	3	1.39	1.40	2.63	2.65	30.9	31.4	30.4	30.4	29.4	29.2	29.2	28.6
			B	SiL	SiL	ML	ML	13	14	75	73	12	13	98.8	99.0	35	33	25	26	10	7	1.48	1.46	2.63	2.65	28.7	31.3	28.0	29.8	26.9	28.5	26.8	28.2
			C	SiL	SiL	ML	ML	15	14	72	71	13	15	99.2	99.4	33	31	27	26	6	5	1.38	1.52	2.64	2.66	32.2	27.8	31.3	27.3	30.2	26.4	29.9	25.8
			D	SiL	SiL	ML	ML	16	15	73	74	11	11	98.8	99.8	31	31	27	26	4	5	1.45	1.48	2.63	2.65	29.2	29.2	28.3	28.3	26.7	27.3	27.1	26.8
		3	A	SiL	SiL	ML	ML	12	16	75	74	13	10	99.0	99.8	35	29	26	24	9	5	1.40	1.50	2.64	2.65	30.9	29.0	30.3	28.4	30.3	27.7	29.1	27.2
			B	SiL	SiL	ML	ML	14	14	74	75	12	11	99.0	99.4	34	32	29	25	5	7	1.39	1.48	2.64	2.66	30.4	29.3	29.8	28.4	29.4	27.7	29.3	27.2
			C	SiL	SiL	ML	ML	14	15	73	74	13	11	99.2	99.6	35	30	26	25	9	5	1.36	1.46	2.64	2.66	33.2	30.2	32.3	29.3	31.7	28.3	31.1	27.7
			D	SiL	SiL	ML	ML	14	10	75	77	11	13	99.2	99.8	34	31	27	25	7	6	1.36	1.46	2.64	2.66	32.7	29.8	31.7	29.2	30.3	28.3	34.1	28.2
		4	A	SiL	SiL	ML	ML	13	14	75	74	12	12	99.4	99.6	34	31	25	24	9	7	1.37	1.50	2.63	2.65	33.2	27.8	32.4	27.3	31.1	26.5	30.9	25.9
			B	SiL	SiL	ML	ML	15	12	75	76	10	12	99.2	99.2	34	32	26	26	8	6	1.38	1.46	2.64	2.66	32.6	29.5	31.5	28.8	31.0	28.5	30.5	28.1
			C	SiL	SiL	ML	ML	13	15	76	72	11	13	99.2	98.2	32	32	26	25	6	7	1.40	1.48	2.64	2.66	31.1	29.0	30.3	28.4	29.9	27.8	28.9	27.4
			D	SiL	SiL	ML	ML	14	14	75	74	11	12	99.2	99.4	33	32	25	25	8	7	1.43	1.48	2.64	2.66	30.4	28.7	29.8	28.0	29.1	27.5	28.9	27.0
		5	A	SiL	SiL	ML	ML	15	14	74	74	11	12	99.4	99.4	34	33	25	24	9	9	1.40	1.46	2.63	2.65	30.4	29.5	29.7	28.8	29.1	28.4	28.3	28.1
			B	SiL	SiL	ML	ML	14	15	75	73	11	22	99.2	99.8	34	32	26	25	8	7	1.27	1.39	2.64	2.66	37.1	31.4	37.2	30.7	36.3	30.1	36.0	29.1
			C	SiL	SiL	ML	ML	15	14	75	74	10	12	99.2	99.0	35	33	26	26	9	7	1.35	1.50	2.64	2.66	34.3	28.0	32.9	27.4	32.2	27.0	31.1	26.8
			D	SiL	SiL	ML	ML	15	13	75	74	10	13	99.2	99.0	34	33	28	25	6	8	1.42	1.47	2.64	.66	30.5	28.0	29.5	27.8	28.7	27.2	28.5	27.0
G VI	F2	1	A	SiL	SiL	ML	ML	13	10	73	75	14	15	99.2	99.8	38	33	26	25	12	8	1.53	1.51	2.65	2.68	26.2	28.0	25.1	26.9	24.7	26.3	24.6	26.2
			B	CiL	SiL	ML	CL	12	12	74	74	14	14	99.4	99.8	37	33	26	23	11	10	1.54	1.51	2.66	2.67	26.1	28.4	24.9	27.2	24.5	26.5	24.4	26.3
			C	SiL	SiL	ML	ML	13	9	74	77	13	14	99.4	99.8	34	35	26	25	8	10	1.48	1.46	2.66	2.68	28.3	31.4	27.2	29.3	26.9	28.2	26.7	28.0
			D	SiL	SiL	ML	ML	13	9	75	76	12	15	99.2	99.4	36	34	26	26	10	8	1.44	1.46	2.65	2.67	29.5	30.0	28.5	28.7	28.3	28.3	28.1	28.1
		2	A	SiL	SiL	ML	ML	10	8	77	74	13	18	98.6	99.8	37	36	25	25	12	11	1.42	1.40	2.66	2.69	31.4	32.9	30.1	31.8	29.8	31.2	29.7	30.9
			B	SiL	SiL	ML	ML	11	9	76	76	13	15	98.2	99.8	36	35	25	24	11	11	1.40	1.44	2.66	2.67	32.7	31.0	31.2	29.6	31.0	29.1	30.9	28.7
			C	SiL	SiL	ML	ML	10	9	76	77	14	14	98.8	99.8	36	34	25	25	11	9	1.40	1.42	2.66	2.68	32.1	32.1	31.1	30.5	30.7	29.5	30.5	28.9
			D	SiL	SiL	ML	ML	9	10	77	76	14	14	99.2	100.0	36	33	27	24	9	9	1.42	1.48	2.66	2.68	31.4	30.3	30.4	29.0	29.9	28.3	29.8	28.1
		3	A	SiL	SiL	ML	ML	12	8	75	76	13	16	98.8	99.8	36	34	27	24	9	10	1.45	1.47	2.66	2.69	30.0	29.9	29.1	28.9	28.8	28.4	28.8	28.3
			B	SiL	SiL	ML	ML	12	9	76	77	15	14	99.0	99.8	37	34	27	25	10	9	1.39	1.46	2.66	2.68	33.0	31.7	31.2	29.9	30.4	29.0	30.4	28.8
			C	SiL	SiL	ML	CL	11	8	77	76	12	16	99.2	100.0	34	34	28	23	6	11	1.46	1.50	2.66	2.69	29.5	29.2	28.3	28.1	28.2	27.7	28.0	27.5
			D	SiL	SiL	ML	ML	12	10	76	77	12	13	98.2	99.8	39	33	30	24	9	9	1.42	1.48	2.66	2.68	30.7	29.5	29.6	28.1	29.4	27.6	28.5	27.4
		4	A	SiL	SiL	ML	CL	13	10	75	76	12	14	98.0	99.4	37	33	26	23	11	10	1.44	1.44	2.66	2.69	30.7	31.8	29.7	29.6	29.5	28.5	29.2	28.0
			B	SiL	SiL	ML	ML	13	10	75	75	12	15	97.8	99.8	34	34	25	25	9	9	1.42	1.48	2.66	2.69	31.7	30.6	30.5	29.0	30.0	28.3	30.0	28.2
			C	SiL	SiL	ML	ML	13	8	75	78	12	14	97.6	99.6	35	34	27	24	8	10	1.42	1.42	2.66	2.68	31.9	33.2	30.4	31.3	29.7	30.0	29.7	29.9
			D	SiL	SiL	ML	ML	13	10	74	76	13	14	99.2	99.4	37	35	26	26	11	9	1.37	1.44	2.66	2.68	33.4	30.6	32.0	29.3	31.6	28.3	31.5	28.2
		5	A	SiL	SiL	ML	ML	13	10	74	76	13	14	97.8	99.6	37	33	26	25	11	8	1.48	1.47	2.65	2.69	29.0	30.9	27.8	28.9	27.4	28.1	27.2	27.8
			B	SiL	SiL	ML	ML	19	10	69	78	12	12	90.8	99.4	35	32	25	24	10	8	1.46	1.50	2.66	2.69	29.6	29.4	27.9	27.9	27.8	27.4	27.6	27.1
			C	SiL	SiL	ML	ML	20	12	71	75	9	13	89.0	99.6	38	32	28	24	10	8	1.46	1.50	2.64**	2.69**	29.9	29.6	28.5	28.1	28.3	27.4	28.0	27.2
			D	SiL	SiL	ML	ML	22	12	65	74	12	14	86.8	99.4	34	34	26	25	8	9	1.47	1.49	2.66	2.68	30.0	31.1	27.7	29.1	27.4	28.2	27.1	27.9

(Continued)

** Estimated.

Table A2 (Continued)

Site	Plot	Row	Position	Classification USDA 0-6	Classification USDA 6-12	Classification USCS 0-6	Classification USCS 6-12	Sand 0-6	Sand 6-12	Silt 0-6	Silt 6-12	Clay 0-6	Clay 6-12	USCS Fines 0-6	USCS Fines 6-12	LL 0-6	LL 6-12	PL 0-6	PL 6-12	PI 0-6	PI 6-12	Dry Density g/cc 0-6	Dry Density g/cc 6-12	Specific Gravity 0-6	Specific Gravity 6-12	Saturation 0-6	Saturation 6-12	0.015-atm Tension 0-6	0.015-atm Tension 6-12	0.03-atm Tension 0-6	0.03-atm Tension 6-12	0.06-atm Tension 0-6	0.06-atm Tension 6-12
																Falaya Soil Series (Continued)																	
C IV	F3	1	A	SiL	SiL	ML	CL	8	8	80	72	12	20	99.6	99.0	36	43	27	25	9	18	1.45	1.44	2.65**	2.68**	30.8	30.6	29.8	30.3	29.3	30.1	28.8	29.7
			B	SiL	SiL	ML	CL	7	7	80	77	13	16	99.6	99.4	40	43	29	25	11	18	1.42	1.43	2.65	2.67	31.7	31.4	31.0	30.8	30.6	30.7	30.2	30.2
			C	SiL	SiL	ML	CL	8	7	79	74	13	19	99.0	99.0	36	44	28	26	8	18	1.44	1.42	2.65	2.68	30.8	32.2	29.9	31.6	29.5	31.2	29.2	30.7
			D	SiL	SiL	ML	ML	8	6	80	77	12	17	99.2	99.0	37	40	28	26	9	14	1.38	1.40	2.66	2.68	33.3	32.9	32.4	31.7	32.1	31.3	31.7	30.7
		2	A	SiL	SiL	ML	CL	8	9	81	77	11	14	99.4	99.8	36	33	26	23	10	10	1.40	1.42	2.65	2.67	32.7	32.5	32.1	31.4	31.6	30.7	31.2	30.1
			B	SiL	SiL	ML	ML	8	7	83	76	9	17	99.4	99.8	36	34	27	25	9	9	1.40	1.44	2.65	2.67	32.7	31.5	32.0	30.3	31.5	29.8	31.0	29.2
			C	SiL	SiL	ML	ML	8	7	81	81	11	12	99.4	99.6	34	34	27	26	7	8	1.38	1.37	2.65	2.66	34.6	34.7	33.4	33.9	32.9	33.5	32.5	32.7
			D	SiL	SiL	ML	CL	8	6	81	76	11	18	99.4	99.4	37	36	28	24	9	12	1.42	1.46	2.66	2.68	32.6	30.1	31.7	29.4	31.3	29.2	30.9	28.7
		3	A	SiL	SiL	ML	ML	9	7	80	79	11	14	99.8	99.8	33	33	28	25	5	8	1.42	1.46	2.65	2.67	32.1	30.1	30.8	29.3	30.5	28.9	30.0	28.5
			B	SiL	SiL	ML	ML	5	10	77	76	18	14	99.8	99.8	35	32	26	24	9	8	1.39	1.45	2.66	2.67	32.6	30.9	31.8	30.0	31.5	29.6	31.1	29.0
			C	SiL	SiL	ML	ML	9	9	81	78	10	13	99.6	99.8	35	33	27	26	8	7	1.44	1.46	2.65	2.66	31.0	29.8	30.1	29.4	29.7	29.0	29.3	28.6
			D	SiL	SiL	ML	ML	10	9	79	79	11	12	99.8	99.8	36	31	28	26	8	5	1.42	1.44	2.66	2.67	31.4	30.7	30.7	30.1	30.2	29.5	29.8	29.0
		4	A	SiL	SiL	ML	ML	9	9	79	77	12	14	99.8	99.8	35	32	26	25	9	7	1.41	1.48	2.65	2.67	33.1	29.8	31.7	28.8	31.2	28.2	30.6	27.7
			B	SiL	SiL	ML	ML	9	10	78	76	13	14	99.6	99.8	32	33	27	26	5	7	1.42	1.44	2.66	2.67	31.8	30.8	30.7	29.9	30.2	29.5	29.7	29.1
			C	SiL	SiL	ML	ML	10	6	79	76	11	18	99.4	99.6	35	38	27	25	8	13	1.44	1.46	2.66	2.67	31.3	29.5	30.3	28.8	29.9	28.7	29.3	28.3
			D	SiL	SiL	ML	ML	8	7	79	75	13	18	99.8	99.4	32	38	24	25	8	13	1.42	1.38	2.66	2.68	31.5	32.7	30.5	31.7	30.0	31.1	29.5	30.6
		5	A	SiL	SiL	ML	CL	10	10	77	73	13	17	99.4	99.4	32	33	25	23	7	10	1.46	1.49	2.66	2.67	29.2	28.6	28.2	27.8	27.8	27.5	27.4	27.0
			B	SiL	SiL	ML	CL	9	10	78	72	13	18	99.0	99.4	34	35	24	23	10	12	1.48	1.50	2.66	2.67	29.3	27.8	27.9	27.3	27.5	27.0	27.1	26.5
			C	SiL	SiL	ML	CL	9	11	77	72	14	17	99.0	99.0	33	34	26	23	7	11	1.48	1.49	2.66	2.67	29.3	28.3	28.3	27.8	27.9	27.4	27.5	27.0
			D	SiL	SiL	ML	CL	8	8	78	75	14	17	99.0	99.4	34	32	24	23	10	9	1.46	1.46	2.66	2.67	29.7	29.8	28.5	28.5	28.2	29.3	27.7	27.8
F VIII	F4	1	A	SiL	SiL	ML	ML	9	10	77	75	14	15	98.6	99.8	41	37	28	25	13	12	1.38	1.38	2.65	2.68**	32.1	32.2	31.5	31.3	31.4	31.1	30.8	30.3
			B	SiL	SiL	ML	ML	12	9	78	78	10	13	98.2	99.8	39	38	28	27	11	11	1.34	1.39	2.65	2.66	34.2	32.7	33.8	32.0	33.6	31.8	33.0	30.8
			C	SiL	SiL	CH	ML	10	10	80	78	10	12	98.8	99.6	55	40	29	27	26	13	1.34	1.37	2.66	2.67	33.5	33.9	32.8	33.2	32.6	32.9	31.9	32.0
			D	SiL	SiL	ML	ML	12	13	78	74	10	13	98.2	98.2	42	33	30	26	12	7	1.34	1.43	2.66	2.67	34.0	30.5	33.7	30.1	33.5	29.9	33.0	29.1
		2	A	SiL	SiL	ML	ML	11	12	80	76	9	12	98.8	99.4	37	34	31	28	6	6	1.34	1.43	2.65	2.66	34.6	30.9	34.0	30.3	33.7	30.1	32.8	29.1
			B	SiL	SiL	ML	ML	12	11	76	78	12	11	96.4	99.4	46	36	29	25	17	11	1.38	1.46	2.65	2.66	32.2	29.9	32.0	29.1	31.9	28.6	31.0	27.6
			C	SiL	SiL	ML	ML	12	11	75	76	13	13	96.0	98.8	44	34	30	24	14	10	1.40	1.42	2.66	2.67	31.7	31.4	31.4	30.6	31.2	30.4	30.4	29.5
			D	SiL	SiL	ML	ML	10	12	75	76	15	12	95.4	98.2	41	31	28	23	13	8	1.36	1.46	2.66	2.67	33.1	29.1	33.0	28.7	32.7	28.4	32.2	27.7
		3	A	SiL	SiL	CL	ML	12	14	65	72	23	14	95.0	99.0	46	32	26	26	20	6	1.40	1.44	2.65	2.66	31.6	30.5	31.7	29.7	31.6	29.4	31.1	28.7
			B	SiL	SiL	ML	ML	10	13	65	72	25	15	94.8	97.0	49	33	27	24	12	9	1.32	1.46	2.66	2.67	35.3	30.0	34.9	29.3	34.6	28.9	34.1	28.3
			C	SiL	SiL	ML	ML	16	17	69	69	15	14	92.6	90.8	42	31	26	23	16	5	1.36	1.48	2.67**	2.68	34.2	28.7	33.7	28.2	33.4	27.9	32.5	27.1
			D	SiL	SiL	ML	ML	12	15	68	72	20	13	94.6	94.2	44	32	30	24	14	8	1.40	1.48	2.66	2.67	32.2	28.4	32.2	28.3	32.1	28.2	31.8	27.4
		4	A	SiL	SiL	MH	ML	13	17	68	66	19	17	94.0	91.8	51	30	30	24	21	6	1.36	1.52	2.67	2.68**	33.0	27.0	33.4	26.9	33.4	26.8	33.0	26.1
			B	SiL	SiL	ML	ML	15	16	66	70	19	14	93.4	90.8	49	31	30	23	19	3	1.32	1.50	2.67	2.68	36.1	27.0	35.2	26.8	34.8	26.6	33.6	25.9
			C	SiL	SiL	ML	MI	25	21	63	67	12	12	77.4	88.8	35	29	25	24	10	5	1.44	1.48	2.67	2.68	30.0	28.9	29.8	28.1	29.5	27.7	28.8	27.0
			D	SiL	SiL	ML	CL	19	17	70	69	11	14	90.6	92.8	34	32	24	22	10	10	1.37	1.50	2.65	2.66	33.0	27.4	32.6	27.2	32.2	26.9	31.3	26.2
C V	F5	1	A	SiL	SiL	CL	ML	9	9	78	80	13	11	99.4	99.8	37	32	24	25	13	7	1.39	1.44	2.65	2.67	33.7	32.3	33.0	31.8	31.9	30.8	31.6	30.5
			B	SiL	SiL	ML	ML	8	8	80	78	12	14	99.2	99.8	38	36	25	26	12	10	1.40	1.40	2.66**	2.69**	33.6	32.7	33.0	30.8	31.6	29.4	31.5	29.1
			C	SiL	SiL	ML	ML	8	7	79	80	13	13	99.8	100.0	35	33	25	24	9	9	1.44	1.46	2.66	2.69	31.4	31.8	30.8	30.9	29.9	29.6	29.7	29.4
			D	SiL	SiL	ML	ML	9	8	79	78	12	14	99.6	99.8	39	34	27	26	12	8	1.42	1.49	2.66	2.69	32.5	30.2	31.6	29.5	30.1	28.5	30.0	28.1

(Continued)

** Estimated.

Table A2 (Continued)

Site	Plot	Row	Position	Classification USDA 0-6	Classification USDA 6-12	Classification USCS 0-6	Classification USCS 6-12	Grain-Size Analysis, % USDA Sand 0-6	Sand 6-12	Silt 0-6	Silt 6-12	Clay 0-6	Clay 6-12	USCS Fines 0-6	Fines 6-12	Atterberg Limits LL 0-6	LL 6-12	PL 0-6	PL 6-12	PI 0-6	PI 6-12	Dry Density g/cc 0-6	Dry Density 6-12	Specific Gravity 0-6	Specific Gravity 6-12	Soil Moisture, %, at Saturation 0-6	Saturation 6-12	0.015-atm Tension 0-6	0.015-atm Tension 6-12	0.03-atm Tension 0-6	0.03-atm Tension 6-12	0.06-atm Tension 0-6	0.06-atm Tension 6-12
																Falaya Soil Series (Continued)																	
C V	F5	2	A	SiL	SiL	ML	CL	9	10	79	73	12	17	98.6	99.4	35	36	26	23	9	13	1.45	1.45	2.66	2.67	31.2	30.9	30.4	30.5	29.4	29.8	29.0	29.6
			B	SiL	SiL	ML	ML	9	10	80	75	11	15	99.2	98.0	36	35	27	25	9	10	1.41	1.48	2.66	2.69	33.0	30.9	31.6	30.2	30.4	29.4	30.4	29.2
			C	SiL	SiL	ML	ML	6	14	82	77	12	9	99.6	99.8	35	26	26	26	9	9	1.44	1.44	2.66	2.68	32.0	33.1	31.1	31.6	30.0	29.7	29.8	29.4
			D	SiL	SiL	ML	ML	9	11	79	78	12	11	99.6	99.8	33	32	[illegible]	26	9	6	1.46	1.48	2.66	2.68	30.6	31.9	30.1	31.0	29.1	29.7	28.9	29.6
		3	A	SiL	SiL	ML	ML	7	10	81	78	12	12	99.6	99.8	38	31	26	25	12	6	1.48	1.48	2.66	2.67	29.4	30.2	29.0	30.0	28.3	29.1	28.3	29.0
			B	SiL	SiL	ML	ML	9	9	79	79	12	12	99.8	99.8	36	35	26	26	10	9	1.52	1.46	2.66	2.69	28.2	30.8	27.7	30.3	27.0	29.2	26.9	29.0
			C	SiL	SiL	ML	ML	9	8	79	78	12	14	99.6	99.8	36	34	25	24	11	10	1.40	1.48	2.65	2.69	31.9	30.2	31.7	29.6	30.9	28.9	30.7	28.6
			D	SiL	SiL	ML	ML	9	10	78	78	13	12	99.4	99.8	39	34	27	24	12	10	1.43	1.46	2.66	2.68	31.7	30.5	30.4	29.7	29.5	29.0	29.2	28.7
		4	A	SiL	SiL	ML	ML	9	8	79	77	12	15	99.0	99.8	38	36	26	26	12	10	1.50	1.48	2.66	2.68	28.7	31.0	28.0	29.8	27.2	29.1	27.2	28.8
			B	SiL	SiL	ML	ML	10	10	78	77	12	13	99.2	99.4	36	37	26	26	10	11	1.46	1.48	2.66	2.68	29.9	30.1	29.3	29.5	28.6	28.9	28.5	28.9
			C	SiL	SiL	ML	ML	9	8	77	78	14	14	99.4	99.8	38	33	27	24	11	9	1.50	1.48	2.66	2.69	28.4	31.2	27.8	30.4	27.3	29.6	27.1	29.4
			D	SiL	SiL	ML	ML	9	9	78	78	13	13	99.6	99.8	35	35	26	26	9	10	1.51	1.48	2.66	2.68	28.2	29.9	27.3	29.5	27.1	28.7	27.1	28.6
F II	F6	2	A	SiL	SiL	ML	ML	11	12	74	74	15	14	99.6	99.4	38	32	28	26	10	6	1.36	1.42	2.67	2.66	33.3	30.8	32.2	30.4	31.6	30.0	31.0	29.5
			B	SiL	SiL	ML	ML	11	10	77	78	12	12	99.6	99.8	35	33	26	26	9	7	1.28	1.42	2.67	2.67	38.3	31.3	37.0	30.4	36.0	30.0	35.0	29.5
			C	SiL	SiL	ML	ML	10	10	77	76	13	14	99.8	99.8	37	34	26	25	11	9	1.35	1.44	2.68	2.68	34.0	29.9	32.0	29.4	31.4	29.0	30.6	28.6
			D	SiL	SiL	ML	ML	10	10	76	77	14	13	99.6	99.8	36	32	26	24	10	8	1.36	1.40	2.67	2.67	33.3	32.6	32.4	31.4	31.6	30.8	31.0	30.3
		4	A	SiL	SiL	ML	ML	12	13	76	72	12	15	99.2	99.0	34	36	25	26	9	10	1.34	1.41	2.66	2.68**	33.8	32.0	32.7	31.1	32.0	30.5	31.3	30.0
			B	SiL	SiL	ML	ML	18	12	71	74	11	14	99.2	98.8	35	34	26	25	9	9	1.38	1.46	2.66	2.56	32.7	30.6	32.3	29.2	30.9	28.9	30.0	28.1
			C	SiL	SiL	ML	ML	7	12	81	74	12	14	99.2	99.6	34	32	27	25	7	7	1.36	1.42	2.67	2.67	33.6	31.4	31.6	30.3	31.0	29.9	29.0	29.0
			D	SiL	SiL	ML	ML	11	11	77	77	12	12	99.8	99.6	36	34	27	24	9	10	1.36	1.36	2.65	2.66	33.0	33.1	31.4	31.6	31.0	31.3	30.0	29.2
		5	A	SiL	SiL	ML	ML	12	13	79	73	13	14	98.8	99.0	35	33	25	27	10	6	1.28	1.40	2.67	2.66	36.2	31.1	33.3	30.1	32.3	29.5	31.3	28.9
			B	SiL	SiL	ML	ML	11	11	74	74	15	15	98.6	99.4	36	33	25	27	11	6	1.32	1.36	2.66	2.67	34.8	34.0	33.7	33.1	32.9	32.4	32.2	31.6
			C	SiL	SiL	ML	ML	12	12	74	76	14	12	98.6	99.8	36	33	25	24	11	9	1.30	1.46	2.67	2.67	36.3	29.4	35.5	29.1	35.0	28.6	34.1	28.0
			D	SiL	SiL	ML	ML	12	13	76	75	12	12	98.8	99.2	33	32	27	24	6	8	1.31	1.42	2.65**	2.66	34.5	30.6	33.5	30.0	32.7	29.5	31.9	28.7
[illegible]	F7	1	A	SiL	SiL	ML	ML	14	15	76	75	10	10	99.6	99.8	34	31	28	26	6	5	1.37	1.42	2.67	2.67	34.2	34.0	32.8	31.7	32.3	31.0	31.8	30.3
			B	SiL	SiL	ML	ML	15	14	75	76	10	10	99.8	99.8	29	30	27	25	2	5	1.46	1.42	2.67	2.67	31.4	33.2	29.9	31.6	29.7	30.9	29.2	30.1
			C	SiL	SiL	ML	ML	14	14	76	76	10	10	99.6	99.8	38	31	27	25	11	6	1.42	1.41	2.67	2.67	33.4	33.2	32.0	31.4	31.6	30.8	31.4	30.2
			D	SiL	SiL	ML	ML	14	14	77	75	9	11	99.8	99.8	34	32	24	24	10	8	1.42	1.42	2.67	2.67	32.8	34.2	31.5	31.8	31.2	31.0	30.6	29.8
		5	A	SiL	SiL	ML	ML	14	14	77	76	9	10	99.0	99.8	37	35	30	27	7	8	1.39	1.38	2.67	2.67	35.4	35.4	33.6	33.3	33.2	32.9	33.0	32.6
			B	SiL	SiL	ML	ML	15	14	76	76	9	10	99.8	99.8	35	37	28	28	7	9	1.44	1.44	2.67**	2.67**	32.4	32.2	30.6	29.9	30.4	29.5	30.1	29.2
			C	SiL	SiL	ML	ML	15	15	75	75	10	10	99.4	99.8	33	33	28	28	5	5	1.42	1.42	2.67	2.67	34.0	33.7	32.0	31.4	31.4	31.0	31.2	30.6
			D	SiL	SiL	ML	ML	15	16	76	75	9	9	99.4	99.8	32	33	28	26	4	7	1.35	1.40	2.67	2.67	36.0	33.7	33.9	31.5	[illegible]	31.0	33.2	30.6
																Hymon Soil Series																	
C II	H11	1	A	SiL	SiL	ML	ML	19	25	70	65	11	10	93.4	87.4	36	29	26	24	10	5	1.35	1.44	2.67	2.66	34.8	30.6	33.9	29.5	33.8	29.2	33.5	28.6
			B	SiL	SiL	ML	CL	19	34	70	55	11	11	93.8	77.4	36	32	25	22	11	10	1.35	1.48	2.67	2.66	34.6	28.7	33.7	27.3	33.7	27.0	33.3	26.4
			C	SiL	SiL	ML	ML	18	35	70	55	12	10	93.6	78.0	36	28	26	24	10	4	1.32	1.46	2.67	2.66	36.3	29.2	34.8	28.1	34.4	27.8	34.1	27.4
			D	SiL	SiL	ML	ML	21	19	67	69	12	12	92.2	94.4	33	30	27	24	6	6	1.32	1.48	2.66	2.67	36.3	28.4	34.7	27.6	34.4	27.3	33.8	26.9
		2	A	SiL	SiL	ML	ML	20	18	71	73	9	9	94.0	97.4	34	33	29	27	5	[illegible]	1.39	1.40	2.66	2.67	32.3	31.7	31.3	30.1	30.9	29.1	31.0	29.1
			B	SiL	SiL	ML	ML	23	19	68	71	9	10	92.4	96.4	40	28	[illegible]	24	11	4	1.40	1.47	2.66	2.66	30.9	29.7	29.9	28.6	29.3	27.7	29.4	[illegible]
			C	SiL	SiL	ML	ML	24	18	66	71	10	11	86.4	96.6	[illegible]	28	25	25	9	3	1.35	1.44	2.66	2.66	33.0	30.9	30.0	29.7	31.4	28.8	31.6	28.9
			D	SiL	SiL	ML	ML	20	20	71	70	[illegible]	10	[illegible]	96.4	37	[illegible]	27	[illegible]	10	[illegible]	1.36	1.44	2.66	2.67	32.6	31.1	31.4	30.0	31.4	29.7	31.1	29.1

(Continued)

** Estimated.

Table A2 (Concluded)

Site	Plot	Row	Position	Classification USDA 0-6	Classification USDA 6-12	Classification USCS 0-6	Classification USCS 6-12	Grain-Size Analysis, % USDA Sand 0-6	Sand 6-12	Silt 0-6	Silt 6-12	Clay 0-6	Clay 6-12	USCS Fines 0-6	Fines 6-12
Hymon Soil Series (Continued)															
C II	HY1	3	A	SiL	SiL	ML	CL	33	30	60	60	7	10	81.4	83.8
			B	SiL	SiL	ML	ML	31	30	60	62	9	8	81.2	83.4
			C	SiL	SiL	ML	CL	30	38	62	52	8	10	82.6	74.2
			D	SiL	SiL	ML	ML	25	31	66	60	9	9	87.4	81.8
		4	A	SiL	L	ML	ML	38	45	52	48	10	7	73.6	66.2
			B	SiL	L	ML	CL	40	47	51	44	9	9	70.2	65.2
			C	SiL	L	ML	CL	37	49	55	44	8	7	74.4	64.8
			D	SiL	L	ML	CL	37	43	55	50	8	7	72.4	71.8
		5	A	L	SiL	CL	ML	43	33	49	57	8	10	67.0	80.2
			B	L	SiL	ML	CL	43	38	50	53	7	9	73.8	73.6
			C	SiL	SiL	ML	ML	41	39	52	53	7	8	68.8	73.8
			D	SiL	SiL	CL	CL	40	38	52	54	8	8	69.6	73.4

Row	Position	Atterberg Limits LL 0-6	LL 6-12	PL 0-6	PL 6-12	PI 0-6	PI 6-12	Dry Density g/cc 0-6	Dry Density 6-12	Specific Gravity 0-6	Specific Gravity 6-12	Soil Moisture, %, at Saturation 0-6	Saturation 6-12	0.015-atm Tension 0-6	0.015-atm Tension 6-12	0.0[illegible]-atm Tension 0-6	6-12	0.[illegible]-atm Tension 0-6	6-12
3	A	27	28	22	21	4	7	1.41	1.29	2.65	2.66	31.0	34.4	29.4	30.5	28.8	28.5	26.7	26.4
	B	30	24	26	23	2	1	1.40	1.42	2.65	2.66	30.6	32.4	29.0	30.2	25.2	28.9	28.2	26.8
	C	30	25	24	23	6	4	1.37	1.46	2.65	2.66	32.5	30.1	30.8	26.8	29.8	27.9	28.7	27.9
	D	30	29	24	23	[illegible]	6	1.42	1.44	2.65	2.66	29.9	30.8	28.5	29.1	28.1	28.0	28.1	28.2
4	A	27	21	22	21	5	0	1.44	1.50	2.65	2.65	29.0	28.1	27.8	26.6	27.4	25.2	27.2	24.6
	B	24	22	23	18	1	4	1.40	1.51	2.65	2.66	30.6	27.6	29.4	25.6	29.0	24.4	29.1	24.3
	C	27	21	22	19	5	2	1.46	1.54	2.65**	2.67**	28.4	26.1	27.0	24.4	26.6	23.4	26.[illegible]	23.1
	D	32	23	26	20	6	3	1.50	1.50	2.65	2.66	27.2	27.7	26.1	26.0	25.5	24.9	[illegible]	24.7
5	A	29	24	22	22	7	2	1.43	[illegible]	2.65	2.66	29.9	28.1	28.4	[illegible]	28.4	26.1	[illegible]	24.7
	B	30	24	25	21	5	3	1.51	1.55	2.65	2.67	26.5	26.7	25.7	[illegible]	25.3	24.5	[illegible]	[illegible]
	C	25	24	23	22	2	2	1.40	[illegible]	2.65	2.66	32.5	[illegible]	30.3	24.3	29.8	23.8	29.3	23.5
	D	25	21	21	20	4	1	1.51	1.56	2.65	[illegible]	27.1	26.5	26.3	24.8	25.9	24.2	25.7	23.8

** Estimated.

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13. ABSTRACT This study was to determine if the average of soil strength values obtained in a small area can be reliably applied to larger areas. Values of properties used in predicting soil strength and classifying soils were compared for areas differing in size. Six test sites in each of four loessial soil series were established, using series boundaries on soil survey maps to locate the sites. The series were Memphis and Loring in the uplands and Collins and Falaya in the bottomlands. Each site had five sampling rows; each row had four sampling positions. Plots of pedologically distinct soil series were identified from field examination within sites and were used as an additional subdivision of test areas. Soil strength and moisture content data were collected on four visits, other physical property data on one visit. The four series could not be distinguished by soil strength because the cone indexes (CI's) varied widely for any one series and the range of CI for each series was about the same. Soils of the 6- to 12-in. layer of the uplands differed from those of the bottomlands in clay content and plasticity, but not in strength. The poorly drained Henry series and alluvial-fill soils of the uplands, as identified in the field, had the lowest CI's. Certain plots exhibited consistently different CI's for each visit than did other plots in the same series, and certain rows in the same plot showed consistently different CI's. These differences could not be explained satisfactorily in terms of soil series, or soil properties commonly used in the Unified Soil Classification System and the U. S. Department of Agriculture textural classification. Limited data suggest that in future studies a terrain geometry classification system would be useful for identifying areas considered uniform in soil type but variable in strength by indicating areas of differential erosion or deposition. Also, the effect of soil factors such as organic matter content, structure, and natural cementing agents should be determined. In a row of relatively uniform soil, five samplings for moisture content and static physical properties and ten for soil strength should be made to provide acceptable mean values for trafficability use. Appendix A includes basic data for each site.

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14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Loess						
Soil strength						
Soils--Mississippi--Warren County						
Trafficability						
Variation						

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